NATIONAL MUSEUM OF VICTORIA

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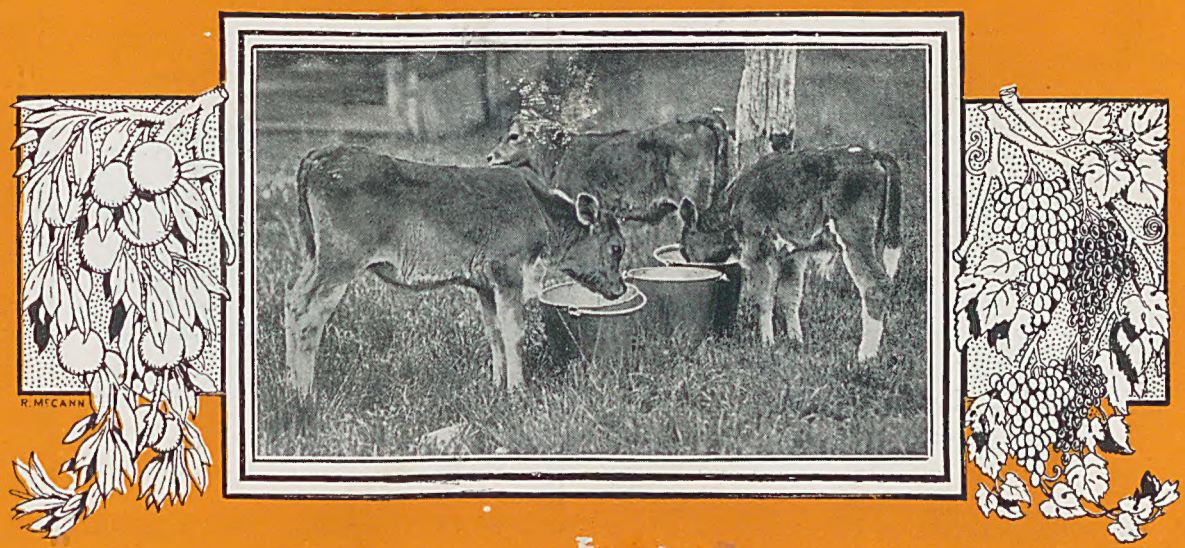
THE JOURNAL OF THE DEPARTMENT OF AGRICULTURE OF VICTORIA, AUSTRALIA.



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Contents.

JULY. 1931.

		PAGE
Pasture Management	*J. E. Harrison, B.Agr.Sc.*	317
Top-Dressing Results at Yarra Glen	*F. Fincher*	320
"Biennial Bearing" in Apples	*F. M. Read, M.Agr.Sc.*	321
Insect Pests of Stored Grain	*R. T. M. Pescott, M.Agr.Sc.*	327
Strawberry Culture	*A. G. Strickland, M.Agr.Sc.*	332
Potato Storage Methods	*J. T. Ramsay*	338
Daylesford Potato Crop Competitions	*J. T. Ramsay*	342
Beet Sugar Industry—Operations at Maffra	*W. L. Williams*	345
Marketing of Citrus Fruit	*J. M. Ward*	349
Sheep-Breeders' Field Day	*N. A. Bowman*	351
Clean Milking	*N. R. Trewin*	353
Verrucose Dermatitis or "Grease" in Horses	*S. A. Mountjoy*	355
Orchard and Garden Notes	*E. E. Pescott, F.L.S.*	356
Professional Papers—		
Chemical Studies of Pasture	*W. R. Jewell, M.Sc., F.I.C., &c.*	357
Rose Diseases and their Control	*B. J. Grieve, M.Sc.*	362
List of Licensed Farm Produce Agents		366

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INDEX TO ADVERTISEMENTS

FRONT SECTION

Cockbill, J. vii
Commonwealth Fertilizers & Chemicals Ltd. vii
Cooper Engineering Coy. Ltd. vi
Harper, Robt., & Coy. Ltd. ix
International Harvester Coy. x
McKay, H. V., Massey Harris Pty. Ltd. ... iii
Nightingale, A., Nurseryman iv
Poultry for Settlers v
Rylands Bros. (Aust.) Ltd. iv
Victor Leggo & Farmers Ltd. iv
Victorian Railways ii
Wells, W., Dairy Machinery Specialist ... vii
Yates, Arthur, & Coy. Ltd. ... Cover

BACK SECTION

Australian Cement Ltd. xix
C.O.R. xviii
Dandy Poultry Food xviii
Ford Motor Coy. of Australia Ltd. ... xiv
Gerrard Wire-Tying Machines Pty. Ltd. ... xv
Government Cool Stores xx
Kidd, Miss M. T. xv
London & North-Eastern Railway ... xix
Lysaght Bros. & Coy. Ltd. xv
Meggitt's Linseed Meal xiii
National Trustees, Executors, &c., Coy. Ltd. xvii
Red Polls for Sale xvii
State Savings Bank of Victoria xvii
Shell Coy. Ltd. xi
Texaco Oil xvi
Trewhella Bros. Pty. Ltd. xix
Victorian Dried Fruits Board ... Cover

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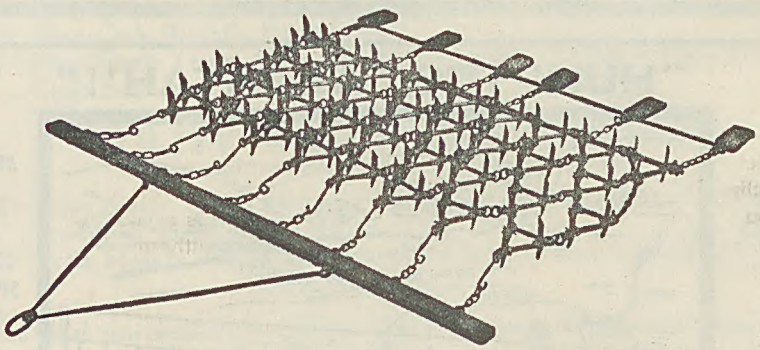

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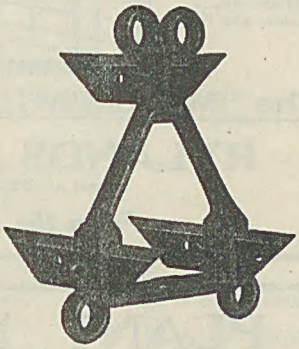

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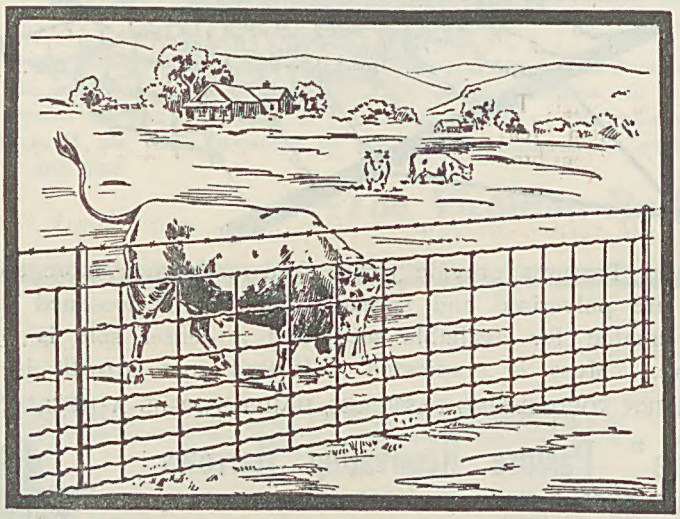

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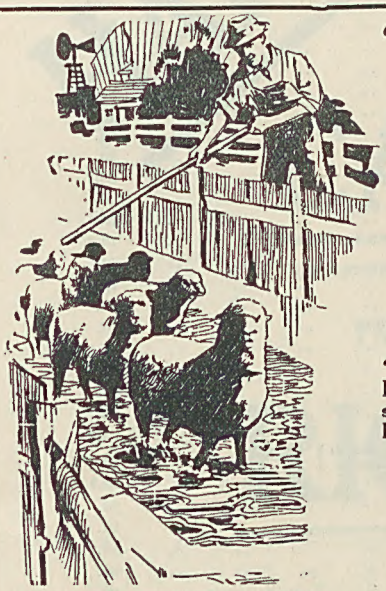

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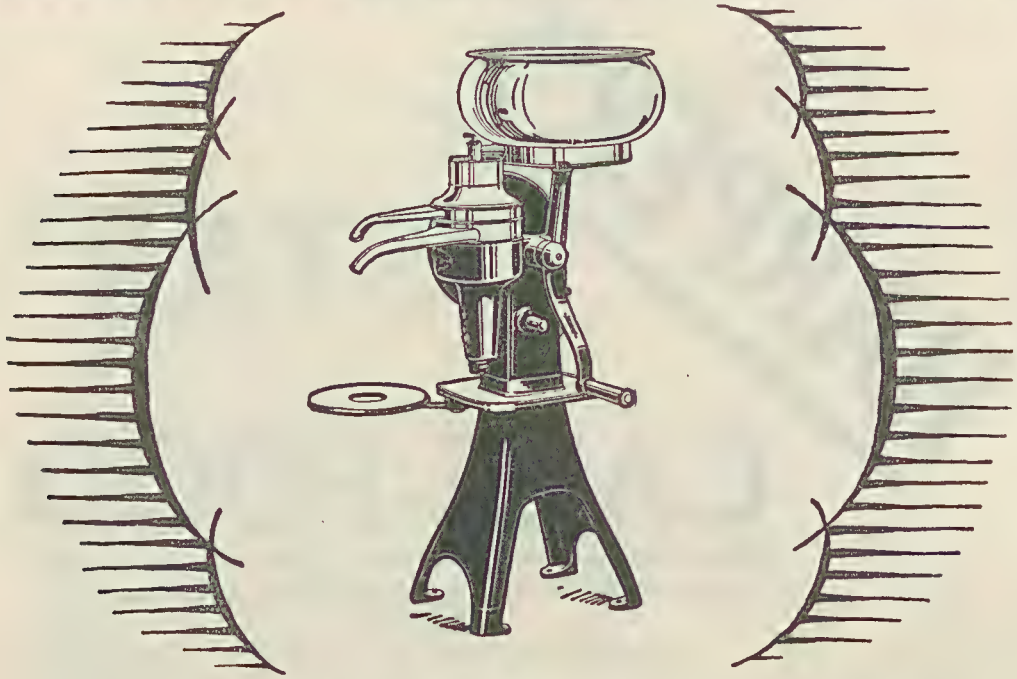

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The Journal of the DEPARTMENT of AGRICULTURE of VICTORIA

Pasture Management

Increasing Carrying Capacity

By J. E. Harrison, B.Agr. Sc., Senior Agrostologist.

A BRIEF account of the pastures on an average farm will raise a mental picture of their present nature, and allow me to suggest developments that will appear natural and orderly steps in the evolution of the farm. No revolutionary suggestions will be made, but a central idea of developing the farm economically from its present position will be maintained.

The farm pastures consist usually of home paddocks and back paddocks. The former generally are small, from 5 to 15 acres, and are convenient to the sheds and the homestead. They are seldom disturbed by cultivation and tend to improve from year to year. They are handy as night paddocks, for which purpose they are frequently used, and increase in fertility from the accumulated droppings of the animals—this, somewhat at the expense of other areas of the farm. If there is any farm yard manure available, it is convenient to spread it on one of the home paddocks, and if top-dressing is an occasional practice rather than a systematic one over the whole farm, it is more convenient to top-dress one of them than one of the back paddocks. It will be readily appreciated then that these small home paddocks contain the best pastures on the farm, and tend to improve in fertility and carrying capacity.

The back paddocks on the other hand are generally in a lower state of development. They are larger, perhaps from 30 to 40 acres in extent, and usually carry dry stock, store, and young stock. They are devoted also to occasional cropping, after which they are allowed to revert to weeds and inferior grasses and clovers. The crops are either sold off the farm, or are fed to stock that graze in the home paddocks. If sold off the farm, these crops represent a direct loss of mineral substances, but if fed to farm stock, most of the minerals are returned to the soil in their droppings, the balance being retained in their bodies or included in the milk taken from them.

The type of agriculture that prevails on these back paddocks is apparently exhaustive. Though the cultivation and cropping do much to ameliorate unbroken soil and prepare a good surface for future pastures, the system tends to reduce soil fertility. In the small home fields, on the other hand, the treatment given not only maintains, but tends to increase fertility, and the pastures improve from year to year. As different management will be necessary to improve carrying capacity in each case, it is convenient to deal separately with them. Let us consider, first, the back paddocks. These may be classed into three groups—

1. Native pastures.
2. Fields gone out of cultivation.
3. Cultivated fields.

Native pastures are difficult to deal with in any simple manner. Top-dressing alone gives uncertain results, though, if persevered with, the proportion of clovers increases from year to year, and the health of stock improves. Clovers such as subterranean, cluster, and suckling, may be introduced by broadcasting in the autumn when the native grasses are

In the Back Paddock.

[Photo. by courtesy Mr. B. A. Barr.

closely grazed or have been burnt off. Harrowing is desirable to make up some sort of seed-bed and bury the seed, but the result is uncertain, and experience goes to show that a more reliable result is obtained by putting such land under crop, and subsequently sowing down to a suitable mixture. Before this is done, however, the value of the stand of native grass should be considered. If all other farm pastures consist of annual plants that leave the ground bare in the summer, the native pasture will afford a little green food at an important time. It should be remembered that the farm is made up of fields in much the same way as a house is made up of rooms, and that it is useful to have them differently furnished. Before changing a field, it is as well to consider its contents, and ask whether a change will improve the farm as a whole. If we decide to retain a field of native grass, top-dressing will increase its feeding value, improve the health of stock, and encourage some useful clovers as well, but if we decide to change the contents of the fields entirely, the best way will be to cultivate and crop, and afterwards sow down the plants desired.

Fields that have gone out of cultivation and are covered with self-sown plants are easily dealt with if not far advanced, but if several years old they are probably like native country again, and should be dealt with accordingly. If not long out of cutivation they most likely carry weeds, annual grasses, and clovers also if phosphates were used at the time of cropping. Top-dressing alone, by stimulating the growth of clovers, will bring about a very satisfactory response on such land, and is the simplest method of improving carrying capacity. Some fields might even respond satisfactorily to more advanced treatment, such as an autumn harrowing or other light cultivation to make a seed-bed, on which suitable grasses and clovers may be sown down with a dressing of superphosphate. The species to sow down are those which will certainly persist, and some which are likely to persist. The seed question is another problem, and it will be sufficient to say that farmers should be at pains to obtain only seed about which they feel no doubt.

The third class of field, that being used for cropping, is in an easy stage to develop as a pasture. Seed can be sown either with the crop, or when the crop has been taken off, and a seed-bed worked up with harrows or other light implement. If this is done in autumn, a light cover crop of oats will give quick feed, and at the same time the tramping of stock will improve the soil for the grasses and clovers that have been sown. If seed is sown in spring, as is often done in Gippsland, millet will make an excellent crop to feed off, and again the heavy tramping

will improve the conditions for the grasses and clovers. These cultivated fields offer special opportunities for pasture development, and I think enough has been said to suggest that the greatest return for capital outlay may be expected from this source.

The home pastures are a different problem, and improvements are to be looked for in other directions. Some may be many years old, and carrying a rich sole of grasses and clovers; others will be developing and improving from year to year; and one or two, perhaps, have been used for occasional cropping, and are the least advanced as pastures. These may be developed by sowing down with reliable seed, harvested, for example, from an old pasture, by top-dressing with phosphates, applying farm-yard manure, using them as night paddocks, and grazing them heavily and regularly.

If we consider the home paddocks critically, we must say that though they are the best on the farm, they are generally of irregular size, and take different times to be eaten down, say, from four to ten days. It must be stated also that they are usually unevenly grazed, and rank clumps of grass grow round the droppings of animals, giving the field a ragged untidy appearance, and reducing the actual grazing area often by one-tenth and even as much as one-third of the total. These two defects—variable grazing periods, and a reduction of grazing area—are important, and while they exist, the pastures will remain below their full producing capacity. The remedy in each case will be obvious, but the considerations involved are not so apparent, and are worthy of careful attention.

In small fields cattle are forced to be less selective, and all plants are partly eaten. Unpalatable plants are not avoided to the same extent as in a large field, coarse herbage is gradually eradicated, and an even succulent growth is secured. For these reasons improvement in the larger fields is obtained if some subdivision is undertaken, and the fields can be closely and uniformly grazed in rotation. In order to graze the fields in rotation for about equal periods of four days, six paddocks are required, and it will usually be found that the home pastures can conveniently be subdivided to this extent, with no large capital outlay for fencing or watering. If subdivision is arranged so that there are eight or ten paddocks, and two or more fields can be held in reserve, these may be cut for hay or may be retained for winter grazing. This last use—the reservation of fields for winter grazing—is a most promising one, and likely to be very helpful.

The removal of rank growth around animal droppings, or due to other causes, is brought about by the use of the mower to cut down the coarse herbage, and of harrows to break up and distribute the droppings. Once the field is in good order, the mower need seldom be used, except occasionally in the spring when it may be desirable to cut down flower heads or other stemmy growth, but the use of harrows to break up and distribute manure must necessarily be more frequent. The type of harrows to be used depends largely on the nature of the soil and the type of pasture,

A Typical Gippsland Scene.

but it is a fairly safe rule to use light harrows on light or thin pastures, and, if necessary, heavy ones on strong dense pastures. Diamond and chain harrows are both very suitable for breaking up manure, or a combination of both may be used for any heavy work on a dense pasture. It has not yet been proved that the use of heavy grass-land harrows is either beneficial or necessary on most pastures in the State.

With the use of mower and harrows, a field may be brought into a very attractive condition, in which, to use a homely phrase, there is "milk in every mouthful." It will be apparent, however, that if time and money are spent on pastures, there is less for the work of cropping, and one or other must suffer. Progressive farmers who have already subdivided their home pastures, and are giving them mechanical treatment in addition to the orthodox dressing of phosphates, are realizing that there is not the necessity to crop to the same extent as formerly. No one would say that there is not a place still for our summer and winter fodder crops, but if attention is given to pastures along the lines indicated, an increased amount of nutritious fodder will be obtained from them, and the amount it is necessary to produce from crops will be correspondingly reduced.

It is appropriate to point out that any scheme to improve farm pastures should be supported by plans to improve and increase the number of stock on hand. If the carrying capacity of a farm is increased, the farmer will often find it costly to buy in the open market, as many have done at high prices this season. This contingency will be avoided if a balance be kept between one farm activity and another, and provision be made to meet at least those situations which can be readily foretold.

Top-Dressing Results at Yarra Glen

By F. Fincher, Dairy Supervisor.

AN instance of the value of pasture top-dressing is to be seen on the property of Mr. A. Hubbard, at Yarra Glen. The farm is about 120 acres in area; the country is undulating, the soil from light to medium in quality. The average annual rainfall of the district is from 30 to 32 inches.

Some years since, Mr. Hubbard began to top-dress portion of his pastures, and gradually extended the practice, until now the whole of the pasture is top-dressed annually. Superphosphate is broadcast during July or August at the rate of a bag per acre. To-day, a thick sole of grasses and clovers covers the paddocks. Mr. Hubbard says that since top-dressing was begun, the carrying capacity of his farm has greatly improved. At one time, 5 acres had to be allowed for each head of stock; now 2 acres is sufficient. The stock on the farm at present consists of 49 cows, 27 head of stock from 12 months to 2½ years, 2 bulls, and 3 horses.

It is the practice to set aside two small paddocks (about 5½ acres in all) for grass hay. Usually these paddocks are closed in September, and a luxurious growth of rye grass and clover is ready for the mower by December. Portion of an area of 20 acres is utilized for the growing of oats for hay and green-stuff, and on the balance maize for summer feeding is grown.

The grass land is subdivided into a number of small grazing paddocks; this means that cattle are assured of fresh pasture. Mr. Hubbard believes in supplementing pasture-feeding with concentrates, especially during the colder months. The concentrates used are chiefly bran and cottonseed meal; the daily allowance per cow is 6 lb.

The herd consists of pedigreed and grade Ayrshires. The pedigreed cows are being tested under the Government Standard Herd Test, and their progeny are replacing the grade animals. The heifer calves are fed for the first three or four weeks on new milk only. During the next six or eight weeks the milk allowance is reduced by half, and a quarter of a pound of some reliable calf food is substituted; from then on the quantity of milk is gradually lessened, and the allowance of calf food increased; in addition they are given a little chaffed maize and hay, with bran and crushed oats. Usually when they are turned out on to pastures they are in a thrifty but not overfat condition.

"Biennial Bearing" in Apples

By F. M. Read, M.Agr.Sc., Senior Horticultural Research Officer.

THE irregular bearing of his trees from year to year undoubtedly constitutes one of the most serious problems facing the Victorian fruit-grower. In the first place, were it possible to secure uniform cropping over a period of years, harvesting and packing could be carried out with more economy. At present, the equipment necessary for handling the crop in the "heavy" year is not used to capacity in the ensuing "light" year. Again, cool store and shipping space could be more satisfactorily arranged, for the demands each year would not vary to the extent now experienced.

A very heavy crop on a spur-pruned tree is usually followed by a light crop.

From the marketing point of view the position is even more serious. In the "heavy" year the market usually is depressed; and thus relatively unprofitable for most growers. In the "light" year, although prices improve, the increase generally is not sufficient to compensate for the low yields. Our overseas transactions also are seriously disorganized, for a steady reliable trade cannot be established when supplies cannot be guaranteed from year to year.

It is not suggested that these considerations are new. They are not. The general position has been stated as an introduction, to make quite sure that the very material importance of the somewhat technical remarks which are to follow is not underestimated.

"Biennial" or "alternate" bearing is not a purely local problem. It is experienced in all countries where fruit is grown, and in most of those countries is attracting very careful attention. Practically all varieties, and all classes of fruit, to some extent, are subject to the rule that, if the tree bears a heavy crop one year, a lighter crop the next year is to be expected.

Certain varieties, such as the Reimer apple, seem to be, by nature, biennial bearers, while others, such as the Jonathan, can be thrown into this habit by any agency which greatly reduces the crop during a particular year.

This article is based on an address delivered by Mr. Read on 28th April, 1931, under the auspices of the Victorian Fruit Marketing Association.

"Statesman" apples in full bloom.—A moderate blossoming is ample.

For instance, in Victoria thrips attacked the apple blossom in the 1926-27 season, seriously reducing the crop and, ever since, on most orchards, large crops and small have followed each other with monotonous regularity.

Let me say at once that I am unable to propound a remedy for the trouble, although it is felt that by the adoption of certain measures its severity may be lessened. It does seem desirable to sum up at this stage what is known of this phenomenon so that growers may be stimulated to give it even more detailed attention, and to bring under notice of this Department anything which may be of assistance to those of us who are giving it a great deal of thought.

Factors Affecting Yield.

The number of apples borne on a tree in any year is dependent on (*a*) the number of blossoms which form; and (*b*) the percentage of these blossoms which set and form fruit. In considering the question of biennial bearing or, in fact, the question of low yield, quite apart from any other considerations, it is essential to keep these two factors quite separate.

Usually biennial bearing is due to the fact that in the light year relatively few blossoms form, while in the heavy year blossoms are excessive. It is to this phase that we propose to devote our attention. Before doing so, however, let me briefly touch on the case of a tree which blossoms freely, but fails to set a satisfactory crop. This is due probably to faulty pollination, in which case suitable cross pollenizing varieties should be introduced. On the other hand, it may be due to faulty nutrition of the tree. Nitrogen is often the important element for fruit setting, and an application of, say 3 lb. of some nitrogenous fertilizer such as sulphate of ammonia per tree two or three weeks prior to blossoming often will improve the set of the fruit.

Let us turn now to the true "biennial bearer"—a tree which flowers profusely one year, and sets a good crop, but in the succeeding year blooms but sparsely and carries little fruit.

Bud Initiation and Development.

Every bud which develops on a tree is a potential flower bud. That is to say, at a very early stage in its formation one cannot say whether the bud will be finally a leaf bud or fruit bud. This is because both buds develop from the same rudimentary materials, and it is mainly the food supply received by any particular bud that decides whether it shall develop into flower or leaf. Most of the dry matter of a plant is built up by its leaves from gases it absorbs from the atmosphere and which (in the presence of sunlight and the green colouring matter of the leaf, chlorophyll) it can elaborate into sugars and starch and similar compounds of a more complicated nature. From the roots come the water, and small quantities of minerals. It is thought that the balance between the sugars and starches, &c.—the carbohydrates—built up by the leaves, and the minerals, especially nitrogen, coming from the roots, largely decides whether a bud is to form flower or leaf. It is considered that, at the critical time of the year, when a bud is about to develop in one direction or the other a large amount of carbohydrates from the leaves, with a relatively small amount of nitrogen from the roots is favorable to the formation of blossom buds. This critical period, when blossom buds are first initiated, occurs very soon after the extension growth of a tree has ceased for the year —usually December.

It is easy to pick out a tree which is carrying a light crop by the abundance of its foliage—a fact well known to most orchardists —and it is probably because of its excellent foliage in the light year, and the large amounts of carbohydrates consequently built up by these leaves that, in the ensuing year, the blossoms are so numerous. Conversely, in the heavy year, the leaf area is very much restricted, the carbohydrates elaborated are correspondingly low, and the tendency is for the rudimentary buds to form mainly leaf buds and relatively few blossom buds for the following season.

There can be little doubt that this cycle does go on, especially where most of the fruit is carried on spurs and little use is made of lateral fruiting. Careful measurement in this country, and in others, has disclosed that the leaf area of an apple tree in its bearing year may be 50 per cent. less than in the non-bearing year. This is due to the smaller number of leaf buds—and therefore leaves—and to the smaller size of the leaves which form. The flowering so lowers the reserves of carbohydrates in the tree that leaf growth in the early part of the "heavy" year is much reduced.

As the understanding of the biennial bearing habit rests on a knowledge of this food balance idea let us spend a little time on it.

Illustrations of Carbohydrate-Nitrogen Theory.

On the carbohydrate-nitrogen ratio idea one can group fruit trees into three main classes:—

1. The trees of poor growth, which may be termed weakly vegetative. Their relatively scanty leaves synthesize insufficient sugars, starches, and other carbohydrates to develop a strong crop of blossom for the following year, and bring the resulting fruit to maturity. Such trees generally are lacking in nitrogen as well.
2. The fruitful trees of medium growth. These develop a good foliage, and have therefore plenty of reserve carbohydrates with which to develop fruit buds as well. These trees have sufficient nitrogen, but not an excessive supply.
3. Strongly vegetative trees, whose supply of carbohydrates is high, but whose nitrogen supply is also high—this latter fact causing most of the carbohydrates to produce growth. If there is unlimited nitrogen it combines with the surplus carbohydrates to produce growth, and prevents the storage of this surplus in the trees' reserves.

As a further illustration of this principle let us consider the growth of individual laterals. Take the Jonathan as an example—here we get the same three classes:—

1. A weakly vegetative lateral (Fig. 3, C.) if left uncut will produce in its second year very little terminal growth, with small leaves, and will fail to produce good fruit buds on the two-year-old wood. If they do form, these blossom-buds are not strong enough to set fruit. Such laterals obviously demand hard cutting back to limit growth to fewer buds and to induce moderate growth and fruitfulness.

2. There are laterals (Fig. 3, B.) which, if left uncut, will produce moderate terminal growth and fruit buds in the two-year-old wood below. Such laterals may be lightly tipped to prevent the terminal fruit bud (which is sometimes present) from forming, if this is desired. These cannot be cut hard, however, because that probably would cause too vigorous growth and prevent the formation of fruit buds below.
3. There are also the strongly vegetative laterals (Fig. 3, A.) which tend to run to excessive growth and no fruit bud formation. If these are cut at all the resulting growth is accentuated, and they are thrown further from a fruitful condition. Obviously, such laterals should not be cut back. The only chance one has of making them fruitful is to have so many of them that the growth of each is reduced to a reasonable amount.

Many growers apparently do not realize these essential differences in laterals. There can be no rule of thumb in pruning. Every district supports a different type of growth and demands distinct treatment. The fundamental principles on which pruning is based apply to all trees, but their application must vary from district to district, and even from tree to tree.

Finally, let us consider the spurs. Each spur functions as an individual, and although the condition of the tree as a whole to some extent affects the behaviour of the spurs as a whole, nevertheless the conditions in the spur itself mainly decide the behaviour of that spur. Its supply of carbohydrates is drawn principally from its own leaves. It is obvious to any one familiar with fruit trees that spurs, as was pointed out clearly by Roberts, of Wisconsin, fall into several classes. Let us take the case he quotes as an example. In an examination of a large number of spurs of Wealthy apple trees he found four classes, as follow:—

1. Very short spurs, averaging one-eighth of an inch in length; these were rarely able to form fruit buds;
2. Short spurs, averaging three-sixteenth inches in length, which usually flowered, but failed to set fruit;
3. Medium spurs averaging one-half inch long which were the most fruitful class; and
4. Long spurs, averaging three-quarters of an inch and over, which usually failed to form fruit buds.

Although these measurements may not coincide with our own in all cases the example typifies what most orchardists know well—that there are differences between spurs, and that these differences are significant. The grower must so regulate the growth of his trees by pruning, manuring, and so on, that he secures the desirable type of growth in the spurs. If a tree is overcrowded with spurs because of the failure of the pruner to reduce their numbers the growth of the spurs will be disappointing and their fruiting unprofitable.

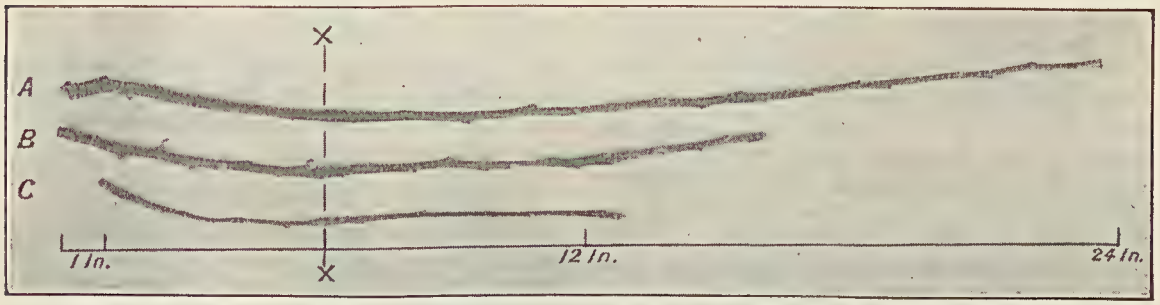
Relation to Alternate Cropping.

In all of these discussions we would appear to have wandered from our main theme of biennial bearing. That, however, is not the case, since the principles discussed are the basis of any treatment adopted for the control of this pernicious habit. The biennial type of growth of such trees is at the root of their biennial fruiting, and unless we can change their growth to a type more uniform from year to year we shall not secure uniform crops of fruit.

As stated earlier, each spur and each lateral of every tree which crops in alternate years has a much greater leaf area in the "off" year than in the "on" year. In December of the "off" year, therefore, carbohydrates are abundant, and the rudimentary buds tend to form blossom buds in nearly every case. These buds flower in profusion the following spring, and act as a drain on the tree's reserves. This results in poor foliage, which elaborates only limited amount of the carbohydrates. In addition, there is the large crop to be matured. The result is a comparative scarcity of the carbohydrates in the "on" year, when fruit-bud initiation should be taking place (December), and relatively few blossom buds form for the following year. This cycle proceeds from year to year.

Possible Methods of Control.

To the growers who wish to experiment (and it is hoped that many will do so), the following suggestions may serve as a guide. The general aim will be to reduce the blossoming



Jonathan laterals.—To left of line x———x, 2 years old wood; to right of line, current season's growth.

A, Strongly vegetative—unfruitful. B, Moderate growth—note formation of fruit buds. C, Weakly vegetative—unfruitful.

in the heavy year and so aid growth. This would lead to increased blossoming and less growth in the "off" year.

1. Pruning.

When the spurs are so numerous that in the "on" year their growth is small and they fail to blossom a reduction in the number of spurs prior to this "on" year is indicated. It should be remembered, however, that since the spurs act as individuals it is insufficient merely to reduce their number. Each spur (which if left untouched for a few years is usually a compound structure of many buds) should be reduced in size so that growth is encouraged in those buds which remain.

The encouragement of fruiting on lateral wood will greatly improve the position in varieties such as the Jonathan, which form lateral fruit buds on the two-year-old wood fairly readily if the right system of pruning be adopted. If new laterals can be induced to spur up each year more regular fruiting must follow than if most of the fruit is carried on spurs which, if they bear one year, rarely bear the next. Here, again, I would like to put forward a suggestion. It is the practice of many growers, in the winter preceding the light year, to leave many laterals uncut, so as to secure the fruit which frequently forms on the terminal bud. This practice, however, in many districts, results in the formation of fruit buds on the lower portions of this lateral, and these are available for flowering in the "on" year when spur flowering is heavy. In the winter prior to the "on" year, however, their usual practice is to cut the laterals, because they do not desire the terminal fruit. This often results in throwing that lateral into growth, and inhibiting the formation of fruit buds. Unfortunately, this is the year when laterals well furnished with new fruit buds would be very desirable to supply fruit in the following light spur year.

In districts where this is so (and there are districts where it is not so), it would be interesting to see the effect of the opposite procedure. Cut the laterals hard prior to the light year so that they will be thrown into growth and will not form flower buds for the succeeding heavy year. Certainly any terminal fruit will be lost. In the following year, i.e., the winter preceding the heavy spur crop, leave the laterals uncut, or cut them lightly. This will then cause them to grow more moderately and to form flower buds for the ensuing light spur year.

In short, this means that the present practice of cutting hard before the big crop, and lightly before the small crop, should be reversed in an effort to secure more regular blossoming. Obviously, it would be some years before the full effects of such an experiment would be seen. It would be unreasonable to look for the main results in the first season of its application. It would be unreasonable also to apply these measures where the type of growth is not as suggested above. This case is quoted merely as an illustration of our line of reasoning.

2. Thinning of Fruit or Blossom.

Apart from the control of blossoming and crop which can be effected by pruning, certain other measures suggest themselves. The thinning of the crop in the heavy year is often practised; but it is rarely successful in the control of biennial bearing. I know of growers who have removed more than half the crop without affecting the succeeding blossoming in the slightest degree. The reason for

this is not difficult to find. It has been said that the succeeding year's blossom is initiated just at the end of the growing period in any season, say, early December in an average year. It is therefore obvious that, unless the thinning were done very early so that the removal of the fruit would have had time to have its effect on the internal processes of the tree prior to this initiation period, it could have no effect on the formation of blossom buds in that particular year. Thinning of blossom, however, usually has proved effective, and the effectiveness of this procedure even on typical biennial bearers, such as the Reimer apple, which can be caused to blossom in its usual "off" year, by removing its blossom in the preceding "on" year, indicates that the habit of alternate cropping is not an inflexible character of such trees, but is simply the outcome of certain physiological cycles occurring in the tree. There is every reason, therefore, to believe that, as we come to understand better the internal economy of the tree, we shall be able to effect some control of the tree's behaviour.

Blossom thinning can be carried out in three main ways:—

1. All the blossom can be destroyed on half the trees in the "on" year, so that these bear in the usual "off" year. This method is practised by some growers, but is open to the objection that the two lots of trees then demand quite different treatment as regards spraying, manuring, pruning, &c., and they rarely get this differential treatment.
2. Alternate branches of all trees can be denuded of blossom.
3. Obviously the best system would be fairly uniform reduction in the concentration of blossom throughout the orchard. This does not appear impracticable—I believe it could be done quite well by knocking off some of the blossom by striking the trees with some such weapon as a small branch of a tree. Sprays have been tried to destroy blossom, but it has been found very difficult to regulate the percentage of kill by this method, and there is the danger that one may kill all the blossoms. There is room for experiment in this direction.

None of the methods of removing excess blossoms which form is all that could be desired, and it seems infinitely preferable to try and prevent their formation by pruning or, as will be briefly suggested hereunder, by manuring with nitrogen.

3. Effect of Nitrogeneous Fertilizer.

Experiments based on the following ideas are at present in progress in Victoria. No results are yet to hand and, consequently, the practices being studied can not be recommended for general application as yet. They are described as a matter of interest.

It has been said earlier in this article that high nitrogen concentration during blossoming is thought to aid fruit setting, and it appears to be desirable to apply a nitrogenous fertilizer, such as sulphate of ammonia, two or three weeks prior to blossoming in the light year when it is desired to hold as many of the blossoms as possible. On the other hand, since it is not necessary to secure a high percentage set of fruit in the "on" year, owing to the excessive blossoms, it would appear to be wise to omit the nitrogenous application in the early spring of the "on" year.

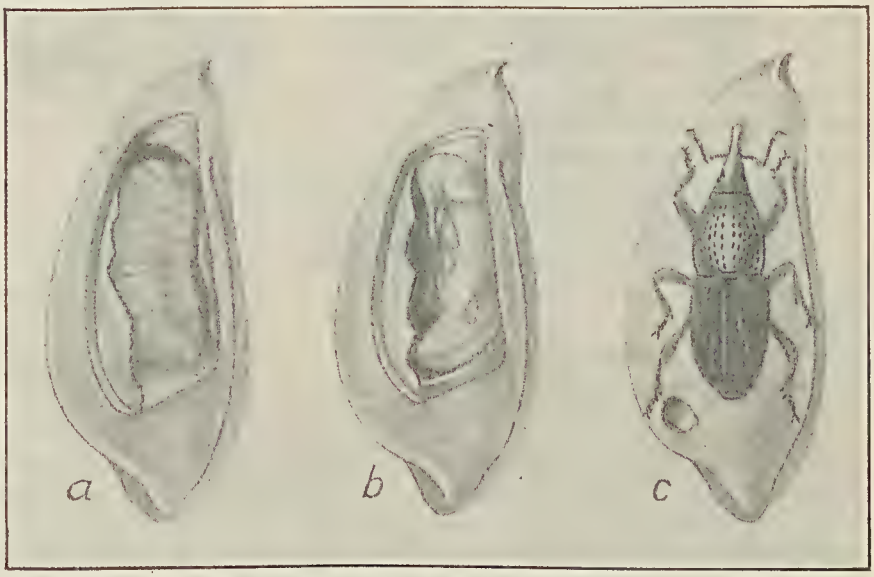
Again, high nitrogen concentration at the time of initiation of fruit buds, say December, is thought to be unfavorable to the initiation of the fruit buds and to favour instead the formation of leaf buds. It therefore appears logical to apply nitrogen towards the end of November in the "off" year so that the formation of fruit buds for the succeeding "on" year may be depressed, and the number of blossoms reduced. It would be undesirable, however, to apply nitrogen at this period in the "on" year, for this presumably would tend to reduce still further the number of fruit buds for the following "off" year. These considerations would suggest that nitrogen should be applied to biennial-bearing trees two or three weeks before blossoming in the light year, and again in late November of the same year. In the heavy year no nitrogen should be given. This system is being tried experimentally in several districts.

Of course, if these measures proved successful, and the cropping of the trees was made more uniform, the necessity for varying the treatment in this way would tend to disappear, and a dressing of nitrogen in early spring every year might be found to meet all requirements.

Insect Pests of Stored Grain

By R. T. M. Pescott, M.Agr.Sc., Entomologist.

AT certain periods of the year large quantities of grain and grain products are stored. The cereal farmer, for example, has his seed wheat, oats, or barley stored for some months, and unless that seed has adequate attention during the period of storage maximum results from the crop cannot be expected. In some cases farmers, and particularly seed-wheat breeders and distributors, hold over a quantity of seed to the second season, particularly if the sample is clean and of good quality. Sometimes also, such growers keep a reserve of some of the high grade, better varieties which might be lost by drought, insect, or fungus pests. In these cases particularly the grain is very susceptible to insect attack, because of the longer period over which it is exposed to the possibilities of infection. The farmer, however, is not the only person interested in the preservation of grain. Those whose business it is to convert this grain into foodstuffs for human consumption have a very live interest in this question. Owing to the long period of storage in such cases, the liability to insect infection is great.



Stages of Granary Weevil in Wheat.
(*a*) Well-grown larva; (*b*) pupa; (*c*) adult.

There are upwards of two score species of insects that may occur in stored grain. Of these, the majority are introduced pests, and are now cosmopolitan, having been distributed by commerce to all quarters of the earth. No insects are more easily carried from one land to another, since they can breed continuously for years in the same grain, and are unknowingly transported when in an immature stage in the kernels. Of the above insects, four only live throughout their adolescent stage within the kernel of the grain. These are the Grain or Granary Weevil, the Rice Weevil, the Grain Moth, and the Lesser Grain Borer. The remaining forms live, not only on the grain itself, but also on the manufactured product, such as flour or meal, and feed as well on various other edible products. Hence, though of comparatively little importance as the authors of primary injury to the seed, they are very frequently the cause of serious damage to manufactured products, and to grain that has suffered first from the attacks of weevils or grain moths, and has been kept for a length of time in store.

The Grain or Granary Weevil.

This insect has been known as an enemy to stored grain since the earliest times. Having become domesticated many years ago, it has lost its wings, and is strictly an indoor species. It is small, slightly shiny in appearance, chestnut brown to black in colour, and has its head prolonged into a long slender snout at the end of which are a pair of stout jaws. Its maximum length is about three-sixteenths of

an inch, but usually it is smaller. It has no wings under the hard wing cases, and the thorax is well marked with longitudinal punctures, two characters which distinguish it from the rice weevil with which it is commonly associated.

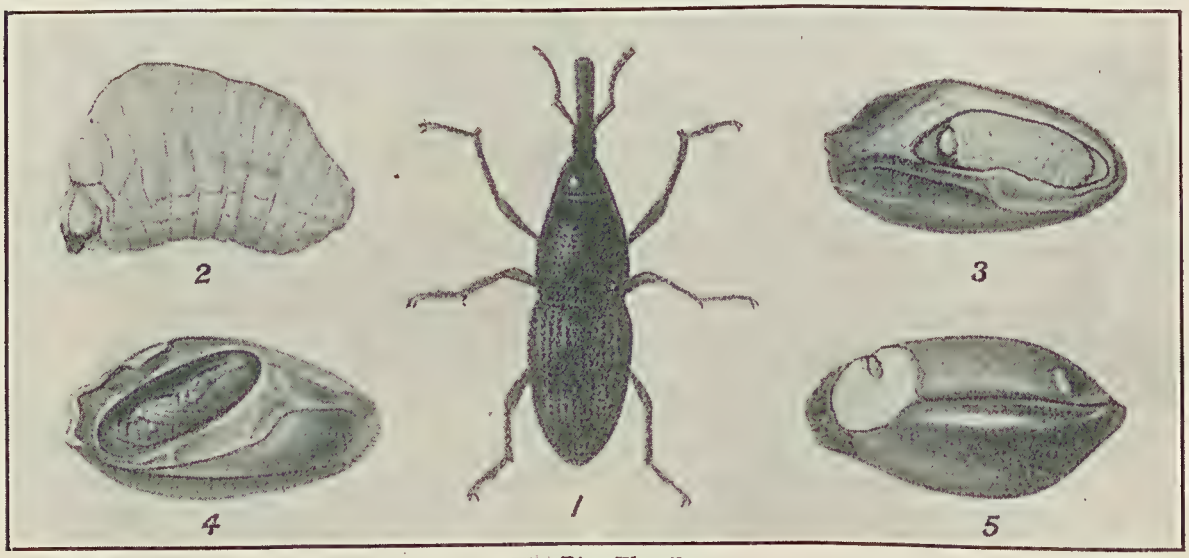
Both the adult insects and the grubs feed extensively on a great variety of grains. Before laying her eggs, the female insect bores a small hole in the grain, and then deposits in it an egg which she covers over with a gelatinous fluid. This egg hatches to a small, legless grub, which burrows into the kernel and feeds on the grain itself. The presence of this insect very often is not suspected until the adult insects emerge from the grain. Normally it takes the grain weevil about four to six weeks to complete its full life cycle, thus, in a year, a great deal of damage may be done to stored grain unless precautions are taken.

The Rice or Black Weevil.

The Rice or Black Weevil is extremely variable in size, but rarely exceeds one-eighth inch in length. It varies in colour from red brown to nearly black, and usually is marked on the back with four light reddish spots. It is very similar to the granary weevil, but has well-developed wings under the wing covers, and this means of locomotion helps in its spread.

This weevil also has been known from earliest times, and is now found in all parts of the world where grain is used. It is probably the very worst pest of all affecting stored grain. It is particularly prevalent in warm countries where it breeds continuously, and rapidly destroys unprotected grain. The adult weevil lives on an average four or five months, and during that time each female lays from 300 to 400 eggs. The life history of this weevil is similar to that of the grain weevil.

The adult rice weevil is a strong flier. In America where the majority of the wheat harvest is handled and stored in bulk, the adult weevils fly from the granaries to the fields of grain and there start an infestation which often proves so disastrous after the grain has been harvested. In Victoria, it can safely be said that this type of infection does not occur at all. A few years ago, because of the large percentage of wheat affected in the stacks on the seaboard, observations were made by the then Government Entomologist to determine where infection took place. Several consignments of wheat were examined when they arrived from the country. While these were quite free from infection when loaded on the railway trucks they were badly infested on arrival in Melbourne. A close examination showed the presence of large numbers of weevils in the crevices of the trucks. This, however, is only one of the many ways by which infection may take place. Second-hand bags constitute another very serious source of infection by weevils.



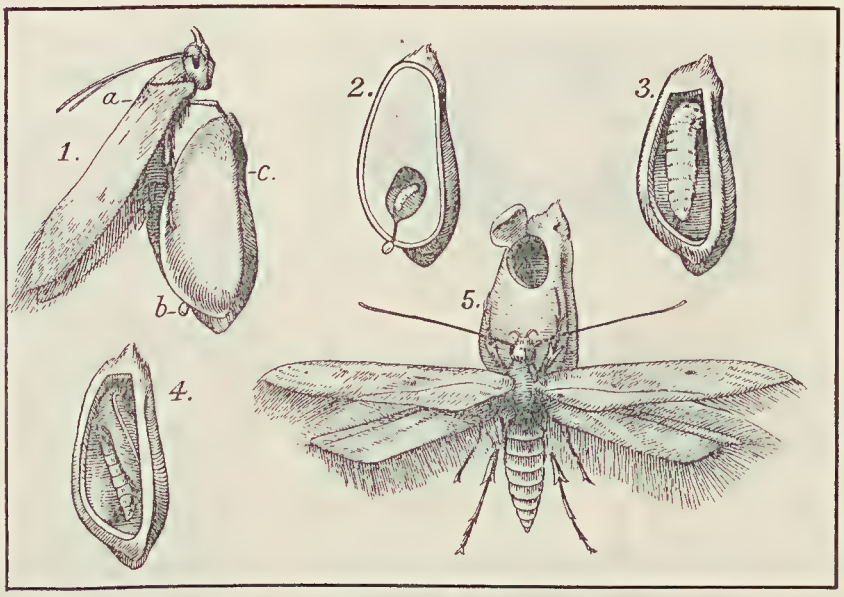
The Rice Weevil.

1.—Adult weevil. 2.—Larva removed from grain. 3.—Larva feeding inside grain. 4.—Pupa inside grain. 5.—Eggs in wheat grain.

The Grain Moths.

The grain moth which is present in fairly large quantities in Victoria is buff or yellow-brown in colour, with a wing expanse of about half an inch. It attacks all classes of grains, particularly maize, and is found in grain both in the field and in store.

There is a widespread opinion amongst many farmers that the grain moth is a stage of the weevils just described, but a knowledge of the life history of this insect soon dispels the idea of any connexion between the two. The adult insect in this case is a moth, not a beetle. Each female moth may lay as many as 400 eggs, which are whitish in colour, and are laid on or near the grain. This egg hatches to a minute white caterpillar which bores into the kernel of the grain and then commences feeding. When fully green, it eats out a channel to the outside of the seed, leaving, however, a thin layer of the seed coat intact. It later turns to the adult moth, pushing its way out through the thin section of seed coat left. The complete development from egg to adult occupies about five weeks.



Life History of Grain Moth.

1.—Adult moth (*a*) lays egg (*b*) on grain (*c*). 2.—Section of grain showing entrance channel and larva inside the grain. 3.—The full-grown larva and the cavity it has made. 4.—The pupa; and 5.—The moth leaves the kernel by the round hole shown.

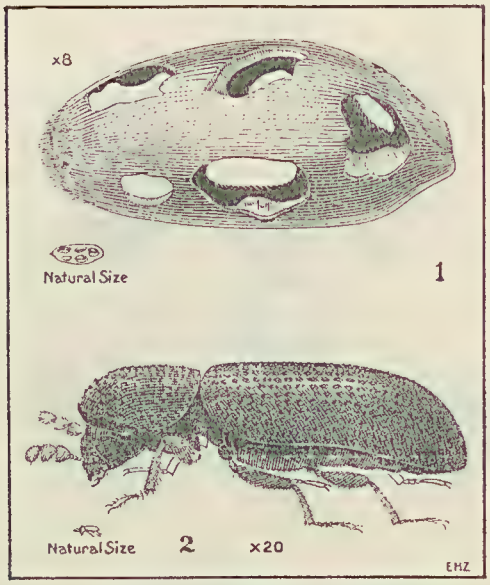
The grain moth works at a lower temperature than the weevil, and consequently does more damage during the winter, laying eggs when the weevil is quiescent. For this reason where the moth is troublesome it would be advisable to dry or cure ears of maize as quickly as possible and store in bins after fumigation. The seeds will require attention again on the first signs of spring. It seems also as if the grain moth in all stages resists fumigation in the winter when the temperature is low. It is therefore advisable to select a warm day for fumigation should winter treatment be necessary.

The damage to germination done by the moth grubs is not as great as that done by the weevil, on account of the narrow straight borings of the moth, usually through the starchy portion of the grain, and also because of the inability of the adult moth to do any further damage by boring. Experiments have shown that a germination of 80 per cent. can be obtained with seed maize damaged by grain moth, but as that percentage of germination is somewhat uncertain, the sowing of such seed is not recommended when better is available. Moreover, even presuming a good germination, the young plant must lose something in vigour when part of the reserve food material in the grain has been destroyed.

The Lesser Grain Borer.

This primary destroyer of grain, particularly wheat, is another cosmopolitan insect, being well known in India, which is probably its native home, but now spread by commerce throughout the world.

This insect belongs to quite a different group to the grain weevils, being found more commonly as wood borers. This species is often found in the wood of packing cases from the East; evidently it was originally a wood boring beetle before it found the contents of the cases suitable for food, and adopted more refined tastes. It has now been recorded from



1.—Grain of wheat attacked by the Lesser Grain Borer.
2.—The Lesser Grain Borer. [*Ag. Gaz.*, N.S.W.

grain, ship's biscuits, stored drugs, numerous types of seeds, and dried roots.

The actual damage to wheat done by the adult is a gnawing of the whole of the wheat grain from the outside until only a shell is left; the beetles then crawl inside and feed upon the inner surface. This damage can easily be distinguished from the more regular holes caused by the true grain weevils.

Each beetle lays an enormous number of eggs, the usual number being from 300 to 400. These are laid over a period of from one to four months during which the adult beetle lives. The eggs hatch quickly in warm weather to a very active grub which immediately moves about searching for food. The grubs are quite unable to enter complete grains, gaining access only when the primary damage has been done by the adult insect. The larvae are particularly fond of flour, feeding usually on the broken down grains left by the adults. After a period of about 10 days they pupate usually inside the grain, finally turning to the adult beetle. The whole life cycle in summer occupies only about 20 to 30 days, while in winter it is longer.

There are normally five broods in a year. The adult insect is about one-eighth of an inch in length, and is about four times as long as it is broad. It is nearly cylindrical in form, the head being large and prominent and bent down under the thorax, giving the appearance of a cowl. In colour it is dark-brown, with the body surface highly polished.

General Control Methods.

The main method of control of these insect pests is the use of fumigation. The benefits of early fumigation of suspected grain cannot be too highly emphasized. Insect damage to grain is not particularly noticeable until the insect developing within the kernel matures, and eats its way out, thus leaving a hole that classifies the grain as "weevily." When a grower finds signs of insect attack at harvest time, he should fumigate his grain at once. It is easier and more profitable to control insects when they are few than to wait until they are noticeably abundant. If the grub inside the grain is killed before it has a chance to develop, serious losses will be avoided.

The usual fumigants in use are known as "heavier-than-air-fumigants." By this term is meant those gases that, being heavier than air, will sink down into the grain in a tight bin, and by forcing the lighter air out, will smother and kill all insects within the bin. In thoroughly tight fumigating bins, these gases can kill all stages of insects—the adult insects crawling between the grain, the eggs laid already in the grain, and the grubs, pupae and adults within the grain themselves. If fumigating bins are not thoroughly tight the effectiveness of the gases is reduced in proportion to the opportunities given the gas for escaping through cracks or other openings in the bottom and sides of the bin.

At present there are a number of heavier-than-air chemical fumigants that offer a safe control of insects under storage conditions. These are carbon bisulphide and certain carbon bisulphide mixtures, ethylene dichloride-carbon tetrachloride mixture, carbon tetrachloride alone and ethylene oxide. Chloropicrin, one of the powerful war gases, shows promise of becoming a practical fumigant for bulk grain, but at present is not commercially available in Australia.

Carbon bisulphide has been in use for years as a standard and successful fumigant for grain. It is not only a very highly inflammable liquid, but also one whose vapours under certain conditions will explode spontaneously. However, with normal care, it is quite a safe material to use. It is always advisable, however, to remember that lighted lanterns, or a fire of any sort, particularly smoking, should be strictly prohibited when fumigation is being carried out. Being heavier than air, the gas

sinks down through the grain, displacing the air, and if the bin is tight enough, becomes sufficiently concentrated to kill all stages of the insect in the grain.

In a thoroughly tight container 4 lb. of carbon bisulphide per 1,000 cubic feet of space (regardless of the amount of space occupied by the grain) will kill all insects. However, it is more usual to use dosages of from 8 to 10 lb. per 1,000 cubic feet. As grain is valuable and the fumigants relatively cheap it is better to use more than is actually necessary and kill the insects than to have to do the job again later. Grain that is to be used for seed purposes should be fumigated for a period of about 30 hours, whilst other grain should be fumigated for about 40 hours. Carbon bisulphide will not injure the germination of the grain, and, provided reasonable circulation of fresh air is provided immediately after fumigation, the grain will not be tainted in any way. It must always be remembered that for successful fumigation the carbon bisulphide must be placed out in shallow saucers on the *top* of the grain to be fumigated. The cost of carbon bisulphide at the present time is certainly not prohibitive, being about 6d. per lb. when bought in gallon lots.

Owing to the risk of fire with carbon bisulphide alone, attempts were made to obtain a fumigant equally as efficient as the carbon alone, but which possessed no explosive properties. This was found in the carbon bisulphide-carbon tetrachloride mixtures, which consists of a small percentage of carbon bisulphide in carbon tetrachloride. Farmers should not attempt to make up this mixture, which may be purchased from reliable chemists. The method of fumigation with the mixture is exactly the same as outlined above.

The ethylene dichloride-carbon tetrachloride mixture is an inexpensive, non-inflammable fumigant that can be used with safety in situations where it is unwise to use carbon-bisulphide. It is made up of three parts by volume of ethylene dichloride and one part of carbon tetrachloride. It should be applied in the same manner as carbon bisulphide and has no adverse effects on germination, nor is it dangerous to handle. It has an anaesthetic action when breathed in concentrated form, but unless the fumes are breathed for a long period no harmful results may be feared.

Carbon tetrachloride is a thin transparent colourless liquid similar in appearance to water. The gas from this liquid has a very pungent penetrating smell. It is not so effective a grain fumigant as any of the above-mentioned, but has the advantage over carbon bisulphide in that the gas formed by its evaporations is non-explosive and non-inflammable in the presence of fire. It is, in fact, a fire extinguisher. Since it must be used in considerably larger doses than carbon bisulphide to obtain approximately the same results; and as the price of the two materials is the same, fumigation with carbon tetrachloride is much more extensive. It is a safe fumigant, but should be used only as a last resort.

Ethylene oxide is a gas which shows promise of becoming an excellent fumigant for stored grain when used in combination with carbon dioxide. It possesses the valuable qualities of being non-explosive and non-inflammable, and being only very slightly toxic to man, but, as yet, it is only in the experimental stage.

Hydrocyanic acid gas is a fumigant much used at the present time. Unfortunately owing to its extremely toxic properties it should not be used by the average farmer. It is used mainly by experts in that particular branch of fumigation or by proprietary concerns where a technical staff is employed. The treatment consists, in brief, of thoroughly fumigating the wheat in a properly closed system with calcium cyanide mixed with sulphuric acid. After the period of fumigation has elapsed, fresh air must be driven through the stacked grain so as to remove danger from the fumes.

Experimental work has shown that, with the exception of ethylene oxide, careful fumigations with the previously mentioned fumigants have no injurious effects upon the germination of the seed. It must be remembered that seed to be fumigated should be thoroughly mature and dry. Newly harvested grain, unless mature and dry, can easily be killed by fumigation. The fumes of ethylene oxide have an injurious effect on the germination of seeds, hence grain intended for planting should not be treated with that fumigant.

A method of control of weevils in grain which is practised by the majority of farmers, probably unthinkingly, is the use of copper carbonate as a dust. This material is extensively used as a fungicide for the prevention of ball smut in wheat. Comparatively recently, it was found that it was decidedly toxic to weevils, none of them remaining alive for more than six days after being placed in treated wheat. As the pickling with copper carbonate may be done months before seeding, this affords protection from weevils as well as from the ball smut.

Strawberry Culture . .

1.—Establishing a Plantation

By

A. G. Strickland, M.Agr.Sc., Horticultural Research Officer.

Fig. 1.—Strawberry Culture among young Apple Trees.

THE strawberry is found in some form or other in almost every part of the world; it is, however, a lover of cool climates, and does best under temperate conditions. The numerous cultivated varieties which are grown to-day have been evolved chiefly from two wild varieties, the common wood strawberry of Europe and North America, and the Alpine strawberry, a more vigorous strain found in the mountainous districts of these two continents. The origin of the common name "strawberry" is in doubt; some writers claim that it has arisen from the practice of mulching with straw, whilst others regard it as a modification of "strayberry," the latter name having reference to the straying or trailing habit of the runners.

The general conditions of the strawberry growing industry in Victoria have varied very little over a long period. According to the *Victorian Year-book* the quantities of strawberries gathered during the period 1924-28 were as follow:—

	Tons.
1924	191.5
1925	292.8
1926	201.0
1927	93.8
1928	247.9

The effects of a severe thrip visitation in 1926-27 are reflected in the low yield of that season, but otherwise the yearly production has remained practically stationary. The major part of the strawberry crop is grown in the central district, but there is no reason why strawberries should not be grown in northern and mid-northern districts, provided that irrigation water is available at frequent intervals. The strawberry is admirably suited to growth as an intercrop in young orchards or vineyards until the trees or vines come into bearing.

Site.

Strawberries blossom and set fruit over a long period, and hence an occasional light spring frost may not do serious damage. However, regions subject to heavy frosts during the blossoming period should be avoided. The site should be somewhat elevated above the surrounding country. A gentle slope, with a northerly aspect, is most suited for early varieties, and, with a southerly aspect, for late varieties.

Soil.

Generally speaking, a deep sandy loam, with a retentive but not impervious subsoil, is suitable to most varieties. Light sandy soils usually are deficient in organic matter, and therefore require heavy applications of farmyard manure, or a programme of green cropping to restore the deficiency. The friable red soils of our hilly districts, such as Red Hill, Wandin, Emerald, &c., have proved suitable for strawberry growing.

Soil Fertility and Manuring.

Farmyard manure is the best general purpose fertilizer: it contains large amounts of humus-forming materials (which improve soil texture), nitrogen, and other plant foods. Well-rotted, stable manure may be applied when the land is being prepared for planting at the rate of 10 to 12 tons per acre on

average soils. Poultry manure, which is richer in readily available nitrogen, should be used in smaller quantities.

Where stable manure is unobtainable, green manure crops are valuable as a means of supplying humus, and at least some nitrogen. Leguminous crops such as peas, beans, clover, &c., are preferable, as they add considerable quantities of nitrogen to the soil. Where it is impossible to secure organic manure, the soil humus must be maintained by growing and ploughing in green crops.

Fig. 2.—Strawberries Planted among Passion Vines.

Considerable quantities of nitrogen, phosphoric acid, and potash are required by the strawberry, and many soils may be deficient in one or more of these nutrients. Hard and fast rules regarding the type and quantity of fertilizer to be applied cannot be laid down owing to the great variation in soil type and climatic conditions from district to district.

Phosphoric acid should be applied as superphosphate, and as Victorian soils generally are deficient in phosphoric acid, dressings of this manure are desirable.

If the soil is naturally rich in nitrogen, or if heavy dressings of nitrogenous fertilizers are applied, abundant crops of large, soft, undesirable berries are produced. Where the nitrogen supply is insufficient, the plants grow slowly, and the leaves are small and light green in colour. Where plants are making good growth and foliage is of good colour, applications of nitrogen may do harm in producing soft, low-quality fruit.

It cannot be said that the need for potash is as apparent in most Victorian soils as is their need for nitrogen and phosphoric acid. Some of the lighter, sandy soils, however, may benefit from dressings of potash.

The quantity of fertilizer that can be profitably applied will vary according to the fertility of the soil in question, and it is suggested that the grower test out the different fertilizers in varying amounts, in order to determine the needs of his particular soil.

It must be remembered, however, that no matter what quantity is applied, artificial fertilizers will not compensate for lack of humus in the soil. The ploughing in of a crop of peas and beans, sown with 4 cwt. superphosphate per acre, before planting with strawberries, will supply humus where stable manure is not available at reasonable cost. Dried blood, stable manure, bone, &c., should be incorporated with the soil some considerable time before plants are set, as they are not quick-acting fertilizers, and require time to be broken down into a form available to plants. The following programme of fertilizing is suggested, subject to modification, according to soil and climatic conditions—

Autumn (before planting)—
2 cwt. superphosphate, or
4 cwt. blood and bone.
1 to 2 cwt. sulphate of potash.

Early Spring—
2 to 4 cwt. superphosphate.
1 to 2 cwt. sulphate of potash.
1 to 2 cwt. nitrate of soda or sulphate of ammonia.

In an established plantation the early spring dressing only will be needed.

According to American experience, the use of lime seems unnecessary in preparing land for strawberries, unless it is required for another crop in any rotation which is practised.

Some of our Victorian soils, however, are extremely acid, and undoubtedly would benefit from moderate liming. A plant failure disease in Scotland is associated with acid soil conditions and lime deficiency, and it would seem that in cases where root failure has been experienced dressings of lime are desirable.

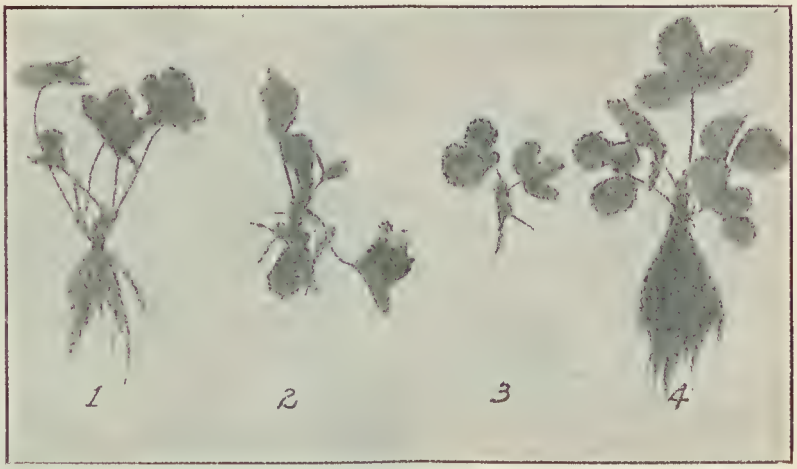


Fig. 3.—1. Over-developed crown and too small a root. 2. Both crown and root too small. 3. A very young and undesirable plant. 4. A properly developed root for transplanting.

[From Bulletin No. 335, April, 1918, Ontario Department of Agriculture.

Preparation of Land.

Soil preparation for strawberry plantations should be very thorough. In Victoria it is usual to plant in autumn, whereas in America planting usually takes place in early spring, as plants set out in autumn do not make sufficient growth before the cold weather sets in.

The land should be ploughed from 6 to 8 inches deep in spring, and allowed to lie fallow until the following autumn. In the meantime a system of underground or surface drainage should be installed if the soil is at all subject to water-logging. Close attention to drainage is advisable in the more humid southern portions of Victoria. In autumn the land should be reploughed in the same direction as the original ploughing, then cross ploughed to a depth of 8 to 9 inches, and finally scarified and harrowed to a uniformly fine tilth.

Planting.

Strawberry plants have been known to survive for a period of ten years without transplanting, and when transplanted every alternate year may last longer. For commercial purposes the life of a plant may be considered as not more than three years.

When a young plant is set out it is approximately six months old, and has a single crown. During the first season stems are sent out in all directions, and at intervals these stems root and form a new plant; the slender stem connecting the old plant dies, leaving the new plant independent and ready to send out runners. These young plants, before they produce fruit, are used for establishing new plantations. Care should be taken in the matter of selecting plants, and on no account should plants be

Fig. 4.—Double or Matted Row System of Growing Strawberries.

taken from diseased or insect-infected areas. Only well-grown plants, with strong fibrous root systems, are worth planting, and preference should be given to those with a medium-sized crown. Plants from old beds which have been weakened by fruit-bearing or crowding are not desirable.

Planting is best carried out in early autumn, so that plants get root-hold before the cold winter months stop all growth. In some cases autumn planting is inadvisable (e.g., where severe frosts occur before the plants are established); the work should then be performed in early spring.

Fig. 5.—Strawberries Planted on the Hill System, Red Hill.

Systems of Training.

There are three main systems of training—the matted-row, hill, and hedge-row systems.

Matted Row.

In this system the rows are planted about 4 feet apart, and the plants 30 inches in the row (4,400 plants per acre). Runners are allowed to develop from mother plants, ultimately forming a solid row from 1 to 2 feet wide; a narrow path 6 inches wide is reserved between rows for the use of pickers. In this system, labour is reduced to a minimum, and exceedingly heavy yields are obtained, though often at the expense of size. The system is an excellent one where fruit is being grown for factory use, but cannot be recommended for the production of choice berries.

Hedge Rows.

This system is a modification of the matted row. Rows are 3 feet apart and plants 2 feet. Each plant is allowed, after the first fruiting season, to produce two or more runners in the row, all other runners being removed. Where two runner plants are allowed to form for each mother plant the result is a single row of plants evenly spaced at 8 inches. Other modifications of this system are used, such as the triple hedge, where each mother plant is allowed to make six runner plants. This system is economical of plants, and enables the production of good-quality fruit.

Fig. 6.—Strawberries Grown on Raised Beds.

[From Circular 23 (Dec., 1928), *Strawberry Culture in California*—California Agriculture Extension Service.

Hill System.

The plants are set from 12 to 15 inches apart in rows 30 inches apart. No runners are allowed to develop, except to fill in misses. Under this system, plants make vigorous growth, and uniformly large fruit is obtained. This system is best when good-quality berries, for fresh fruit trade, are required. At the distances quoted about 14,000 plants per acre are necessary. In Victoria planting has mostly been in rows 3 feet apart, with 9 to 18 inches between plants according to the variety, large-crowned varieties requiring larger distances between the plants in the row. In California, where frequent irrigation is essential, large areas are grown in "raised beds." The plants are grown on wide rows, slightly raised above the intervening spaces, which give room for irrigation, cultivation, and picking. The sunken spaces are permanent during the continuation of the plantation, while the irrigation furrows in ordinary level culture systems are made for each irrigation. The usual width of raised bed and furrow adjacent is from 4 to 5 feet. This system makes irrigation more convenient, because ditches are permanent, and are not destroyed by cultivation. It is open to abuse, however, in that cultivation is neglected in some cases, and the result is a hard-baked path between the rows. The width of these beds is varied according to whether plants are to be grown on a single-row or matted-row system. This method of training might be used with advantage in northern irrigation areas.

Planting the Rows.

The rows should be marked out carefully by means of a wheel-marker or line. The soil should be in moist condition at setting out, and plants should not be exposed to sun or wind for any length of time. Previous to planting, all but the inside leaves of the young plant should be removed, and, if necessary, the roots trimmed to 3 or 4 inches in length with a sharp knife or secateurs.

Fig. 7.—Pruned and Unpruned Plants.

[Wisc. Bull. 360, p. 16.

Setting is usually done by hand, holes being made 4 inches deep and 6 inches in diameter by means of a spade or other implement. Sometimes a shallow furrow is run up the row and plants set along the land-side of the furrow. Whichever system is used the roots of the plant should be well spread, and the soil pressed tightly in around them; loose setting is a frequent cause of failure. When finally settled, the soil surface should be even

with the crowns of the plants; planting either too shallow or too deep must be avoided. A cool, cloudy day, with rain impending, is an ideal time for transplanting.

Interpollination.

The strawberry is somewhat peculiar in that different varieties produce different kinds of flowers. Some varieties, such as Edith, Sunbeam, and Melba, have flowers bearing both male and female organs, and are therefore capable of self-fertilization. Such varieties are said to possess "perfect flowers."

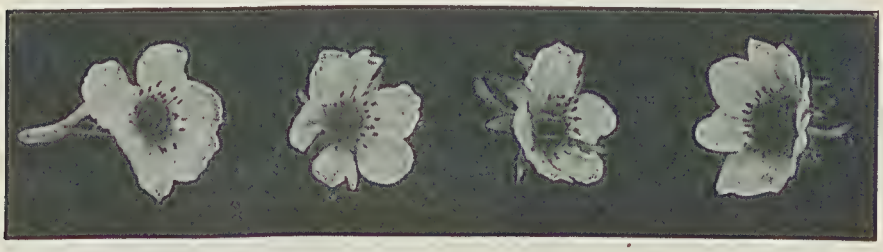
Planted too shallow. Planted at proper depth. Planted too deeply.

Fig. 8.—Depth at which to Plant.

[Reprinted from Bulletin No. 335, April, 1928, Ontario Department of Agriculture.

Others, such as La Marguerite, have only female organs, and therefore cannot produce fruit unless pollen from some other perfect variety with stamens is available. If an imperfect variety (such as La Marguerite) is grown, care must be taken to select a perfect variety for interplanting with it so as to provide for pollination. The interplanted varieties must flower at the same time, and it is desirable that the blooming period of the perfect variety should be longer than that of the imperfect. Even when perfect varieties are grown, it is preferable to plant more than one variety, as in most cases cross fertilization results in more fruit than self-fertilization. Where a pollenizing variety is necessary, the proportion of one row of pollinizing plants to one or two of the variety to be pollenized is quite satisfactory.

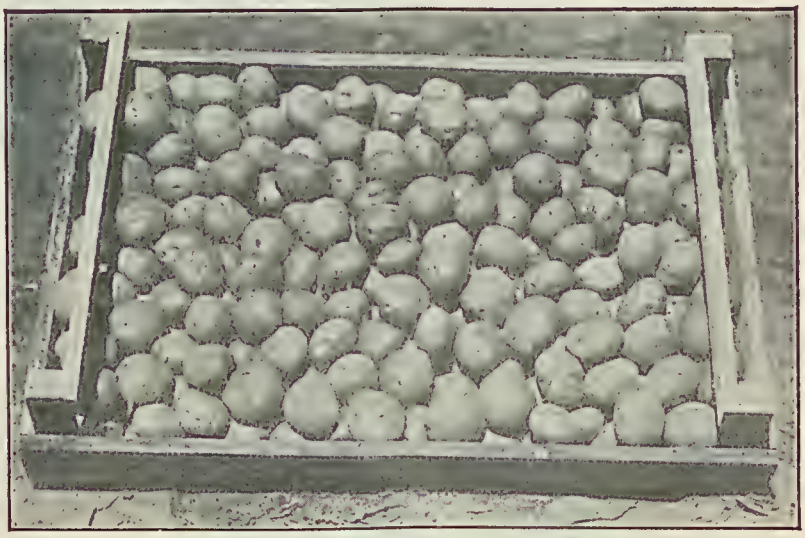
[*A further article will deal with strawberry varieties, the maintenance and care of an established plantation, and the harvesting and marketing of fruit.*]



Potato Storage Methods

By J. T. Ramsay, Potato Expert.

SO far as storage is concerned, potatoes can be divided into two classes: — (1) those intended for consumption, and (2) those intended for use as seed for the following crops. The correct storage treatments for these two purposes are entirely different. Ventilation is essential to the successful carrying out of both but, in addition to ventilation, potatoes intended for seed must have light as well, whereas potatoes intended for consumption must be kept from the light.



Boxed Seed in Ideal Condition for Planting.

The effect of light on potatoes is to develop solanum, which is poisonous, and there are on record cases of stock being poisoned through accidentally gaining access to tubers which had been greened expressly for seed purposes.

Let us consider first the storage of potatoes intended for use as seed. It is essential that these be stored in such a way as will preserve them in sound condition during the period from harvest to next planting time, and the only way to do this is to subject them to a storage environment which will give them abundance of ventilation and ample light. This essential combination can be effected in several ways, some of which are:—(*a*) by storing them at very shallow depths, not more than two or three tubers deep, on racks or shelves in the open; (*b*) by placing them in similar manner inside a shed; and (*c*) by storing them in specially constructed seed potato boxes. Each of these methods produces the same condition, that is, the seed tubers are permitted the amount of ventilation, and the amount of light, requisite for their sound keeping. I want to stress the necessity for this ventilation and light during the storage period of seed potatoes because it is most important. Consider for a moment what happens when seed is subject to storage conditions under which they are denied a sufficiency of ventilation and light. Before many weeks, tubers so stored start to sprout because of the higher temperatures created by natural sweating, and maintained by lack of ventilation. Long before they are required for planting the tubers are overshot with long sprouts, which, because of lack of light, are white and intensely brittle. Such sprouts not only have a most exhausting effect on the parent tubers, but they are also incapable of withstanding without damage the handling incidental to planting. The effect of this is that the bulk of them are broken off, and devitalized seed results.

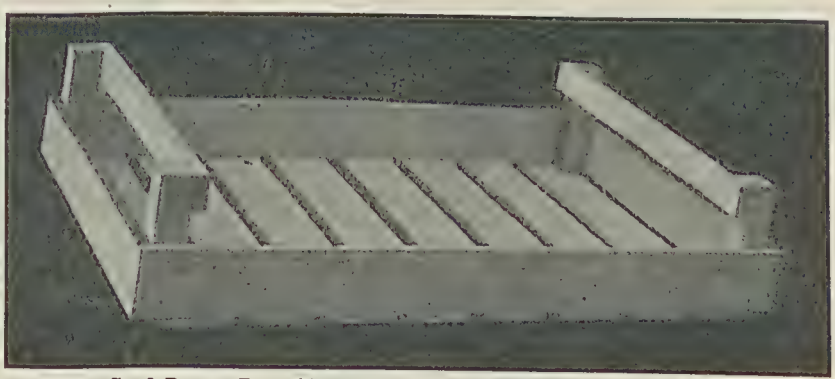
A fairly common practice amongst growers who do not adopt correct storage methods is to break off all sprouts which may be growing from the tubers at the time of planting. This is a certain error. The object of such growers, of course, is to secure some uniformity in the appearance of the crop when it shows through the ground, but the seed suffers irreparably. When desprouting is practised the seed tubers are set back some weeks in their growth and are devitalized to the extent of the nourishment

Potatoes with Shoots too far Advanced. Due to insufficiency of ventilation and light during storage period.

expended in producing the sacrificed shoots. It may be contended, of course, that the sprouts are sometimes too long at planting time to permit the seed to be handled without breaking them. If the seed has long shoots the owner's system of storage is very much at fault, and he should adopt proper storage methods.

Now, let us consider what happens when the seed is given ample ventilation and light. First, the ventilation has the curious effect of concentrating the flow of sap through the channel leading to the terminal bud so that, in the large majority of cases, only one sprout is developed, that of the main eye at the rose end of the potato. This concentration of the whole of the sap of the seed set towards feeding one sprout instead of half a dozen has the effect of giving a much stronger bud or sprout and, consequently, the plant gets a much better start in the season. In this connexion it should be noted that, for the first two or three weeks of its life in the ground, the young plant is totally dependent on the seed set for its nourishment, i.e., up to the time when the roots which develop at the base of the sprouts are capable of functioning and absorbing the plant foods contained in the soil.

The effect of light on the potato is to develop solanum during which process the skin and flesh of the tuber are turned green in colour. This "greening" process, as it is called, is highly beneficial, as it produces a flesh-hardened condition which enables the potato seed in storage to withstand the attack and arrest development of fungus, bacterial, and insect troubles. This, in itself, is of great importance from the purely economic point of view, since it reduces to a minimum loss during storage. The saving effected by the greening of seed has been estimated by growers at from 25 to 60 per cent. The



Seed Potato Box—Size 31 inches x 21 inches x 3 inch Sides.

Evidence of the Advantage of Boxing Seed. Note perfect condition of well-greened short buds on the left.

action of light on the sprouts themselves is no less beneficial. Firstly, it suppresses the growth of the shoot and prevents it reaching an excessive length. Secondly, it greens the sprout as it grows. This greening of the sprout has the effect of toughening it to such a degree that it is capable of standing fairly rough treatment without breaking—a very desirable feature. The importance of that point, i.e., the preservation of the first shoot, is considerable, as will be understood from the following.

If, when a potato sprouts, that sprout is broken off, in the majority of cases it will sprout again, but the second growth will be weaker than the first. Further, if desprouting is continued the time soon comes when the potato so treated is incapable of responding to the repeated demands on its progressively decreasing vitality. From this it may be easily understood how advisable it is to maintain the first sprouts undamaged and the vitality of the seed unimpaired Mention has been made of various methods of storage that will produce the desired condition. Of those mentioned undoubtedly the most efficient and economical in the long run, is that of storage in seed potato boxes. These boxes are now so well known that their description is unnecessary. They are procurable from any of the case-making firms in Victoria. Some reasons why the boxing system is preferable to others producing similar effects are:—(1) space is economized; (2) the seed may be inspected and moved with convenience; (3) the seed is more easily protected from frost and stock; and (4) less handling of the seed is entailed. When seed is stored in pits or heaps, the potatoes cannot be conveniently examined from time to time; the sprouting cannot be regulated, and the sprouted potatoes cannot be handled from the heaps or pits without injuring a large percentage of the shoots, thereby adversely affecting the sets. When seed is stored in boxes the sprouting can be regulated by the admission or the exclusion of light, and the tubers can be carted to the paddock and planted without damage to the sprouts.

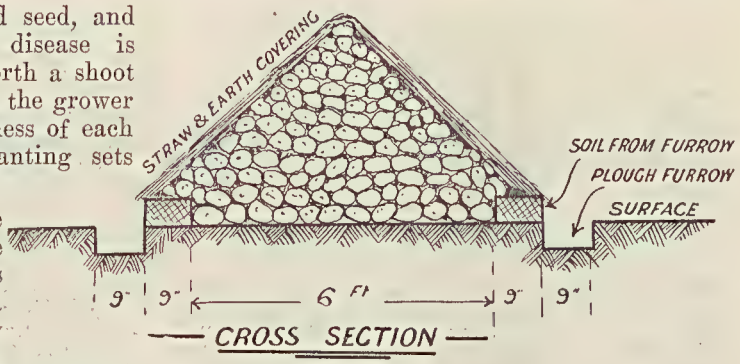
If potatoes are stored in seed-boxes directly after digging, and therefore kept well ventilated, in the majority of cases only one shoot will grow from the terminal bud of each tuber; whereas, if stored in pits, or heaps, shoots will grow from almost every eye. The crop resulting from a potato planted whole, with only one eye sprouted, will give a heavier yield of marketable-sized tubers per acre than will a potato of similar size which has shoots at every eye. Seed sprouted nicely before planting will be ready for digging several

Seed correctly spouted and greened.

weeks earlier than will unsprouted seed, and therefore the risk of attack by disease is decreased. When seed has sent forth a shoot prior to being placed in the ground, the grower can see clearly the vigour or weakness of each individual tuber, and can avoid planting sets which would produce weak plants.

An interesting illustration of the increased yield resulting from the proper storage of seed potatoes is furnished by the experience of a South Gippsland grower a few years ago. Portion of the seed saved from a crop of the "Up-to-date" variety was boxed, i.e., was stored in seed-potato boxes from May until December. Another portion of the seed from the same crop was stored from May to November in bags. In November, when the seed stored in bags was planted, it was found that all the tubers had sprouted from every eye. Those tubers which were considered too large to be planted whole were cut for the most part into two sections. In December the potatoes which had been stored in boxes were planted whole, as the majority of them sprouted only from the main eye. The manure used with each lot of seed was the same, viz., 2 cwt. superphosphate per acre. The soil in which they were planted was apparently of the same quality throughout, and the preparation and intercultivation given to both lots also were identical. Owing to the fact that the boxed seed was not cut, a greater weight per acre of these was planted. The rates of seeding per acre were—Boxed seed, 1 ton per acre; bagged seed, 16 cwt. per acre. Although the boxed seed was planted about one month later than the other, both lots matured at the same time, and when dug gave the following yields:—Boxed seed, 13 tons per acre; bagged seed, 8½ tons per acre. These were sold at £5 per ton on rails, and a simple calculation shows that the boxed seed returned fully £20 per acre more than that portion of the seed which was not boxed.

At the main potato experimental station conducted by the Department of Agriculture at Millbrook, on the Ballarat line, for the four years 1927-28 to 1930-31 inclusive, the average increase in favour of boxed seed as compared with seed stored in bags is not less than 2 tons 9 cwt. per acre, equal to 102 per cent. This surely is adequate proof of the higher efficiency of proper storage.



Potato Pit.

It may be mentioned here that, provided protection from frost be given—and this is only required in the portions of the State of higher altitudes—seed is best stored out in the open air.

Storage of Table Potatoes.

If it is desired to store potatoes for some time after digging, prior to their being marketed for consumption, they should be pitted. Careful sorting to remove all diseased tubers should be done before placing them in the pits, and the site selected for their storage should have perfect drainage. A simple method of making a pit is to turn up by plough or spade two furrows parallel to each other with a space of 6 to 8 feet between them (inside measurement), the empty furrow space, of course, being on the outside of the pit. These upturned sods form the sides of the pit and keep the potatoes up together; the ends may be made either circular or square. The narrower width of 6 feet is recommended for potatoes that are not lifted in the best condition, but where they are ripe, sound, and dry, the wider measurement of 8 feet is quite safe. The sides of the pile should be built up as steeply as possible, so that the covering of straw necessary for protection from light may be assisted in shedding off rain. Should there be any risk of damage by frost, a light coating of soil may be placed over the straw, leaving the ridge of the pit uncovered for the ventilation which is essential for successful storage. Earth storage, or pitting, is the only method recommended for potatoes intended for consumption, as no other method has been found which will retain flavour to the same degree.

Daylesford Potato Crop Competitions

Report of the Judge, J. T. Ramsay, Potato Expert, Department of Agriculture.

THREE cups were offered for competition to potato-growers in the Daylesford district during the past season. One was given by the Daylesford Agricultural Society for the best 2 acres of the Late Carman variety, and attracted eight competitors. For the second, presented by the Commonwealth Fertilizers Company for the best 5 acres of any variety, eighteen entries were received, but only fourteen were judged, there being four withdrawals. The third cup was donated by Messrs. Rowe Brothers, of Italian Hill, Daylesford, who were the winners last year of the cup presented by Messrs. Gooch and Sons, of Wheatsheaf, Daylesford, and seven entries were received. The Rowe Cup competition was confined to the Snowflake variety, and an area of at least 3 acres had to be submitted for judging.

While the aggregate number of entries may be regarded as satisfactory, there is no reason why it should not be doubled in this district, where the potato is one of the staple crops. The Daylesford society, with others, is doing excellent work in organizing these competitions, the beneficial effect of which already can be seen in improved methods of culture and, more particularly, in the higher degree of purity of stocks.

The seasonal conditions were adverse to the Carman crops, but were very favorable to the Snowflake variety and, as a consequence, these latter yielded very heavily. A most noticeable feature of the Snowflakes was their fine shape liness as compared with the average season. Generally, this variety yields a rough type of tuber which is not attractive in appearance. This season, however, they have turned out a shapely type, more resembling Carman than Snowflakes. This improved shape was due entirely to the moist condition of the soil during the latter part of the season (because of the abundant rain), which permitted the development of the tubers without restriction. This particularly suited the Snowflake variety, which has the very marked characteristic of making its tuber growth almost entirely towards the end of the growing period.

While this rare experience of good shaped Snowflakes is easily explicable, it forcibly demonstrates that, in the humus-depleted soils in which they are grown, the rectification of the physical condition of the soil by the practice of green manuring would be highly bene-

DAYLESFORD AGRICULTURAL SOCIETY'S CUP COMPETITION.

Name.	Rows per Chain.	Cleanness.	Evenness.	Quality.	Weight.	Points for Weight.	Total.
Maximum Points	—	10	10	40	—	40	100
					T. C.		
Gooch Bros.	32	9	9	38	9 5	29½	85½
Balharrie, A. S.	28	9	9	38	6 15	21½	77½
Gooch Bros.	32	9	9	38	6 16	21½	77½
Pardon, J.	32	9	9	37	6 8	20½	75½
Balharrie Bros.	29	8	6	20	12 11	40	74
Balharrie Bros.	27	8	7	28	9 14	31	74
Gamble and Son	30	8	8	36	6 14	21½	73½
King, J. M.	29	7	8	35	2 1	7	57

All of the crops in this Competition were Carmans, which averaged 7 tons 10 cwt. 2 qrs. per acre.

ficial. The potato is a moisture-loving plant and, compared with other crops, is capable of utilizing water in tremendous quantities; that being so, anything that can be done economically to improve the moisture retention capacity of soils in which it is grown should receive attention. This would ensure a greater proportion of the rainfall of the average season being available for use by the crop, instead of being dissipated by evaporation. Green manuring is the most economical and effective means of producing this result, and therefore is strongly recommended.

Generally speaking, the cultivation of the crops entered for the three competitions was good. The whole of the entries were very clean, any weeds showing having germinated after the flowering of the crops when, of course, anything but hand-weeding was out of the question. In a number of cases much ground was lost by the spacing between the rows being too wide. Probably this might be accounted for by a very loose condition of the ground at planting time. This would tend to make the soil break away at the edge of the furrow when ploughing the seed in, but it could have been corrected by setting the plough narrower than when ploughing land which was in a good cutting condition. It may seem that the spacing of the crop is over-stressed in these reports, but it is of great importance because of its effect on both yield and quality.

There was a remarkable evenness in the crops, as will be seen from the high percentage of points allotted under this heading. Quality, however, varied considerably, due chiefly to the effects of Rhizoctonia and Virus diseases.

This season, because of the low prices prevailing, offers a splendid opportunity for growers to improve the standard of their seed stocks. If too late to select in the field when digging, then selection for seed should be made only from market-sized clean tubers, and all small seed should be discarded. This will have the effect of eliminating a large proportion of the tubers which may be effected with Virus, as few such plants produce market-size potatoes. If dipping—a very cheap form of disease control—be done in addition to this form of selection, the virility of the seed carried over for next season's planting should be tremendously improved, as compared with the carry-over of ordinary years. It must be obvious that the individual plants which produce best in any season are those which are of the most vigorous constitution and disease-resistant power.

The manuring given to the crops judged ranged from light dressings to none at all. The soils in this district are admittedly rich, but in this connexion I would like to draw the attention of growers to the results of manure trials on potatoes conducted by the Department of Agriculture on the farms of Mr. E. Bull, of Musk, and Messrs. Gooch and Sons, at Wheatsheaf. The soils of these two farms, though not the best in the district, are typical of a very large proportion of it, and the results obtained on them are applicable to that large proportion.

"C.F.C." CUP.

Name.	Rows per Chain.	Cleanness.	Evenness.	Quality.	Weight.	Points for Weight.	Total.
Maximum Points	—	10	10	40	—	40	100
					T. C.		
Pardon, J.	30½	9	9	34	15 15	40	92
Cook, J.	27½	9	8	32	14 4	36	85
Courtney, M. E.	27	9	9	35	12 1	30	83
Orr, W. C.	29	9	9	36	10 15	27	81
Wilkie Bros.	29	9	9	36	10 15	27	81
Bolton Bros.	30	9	9	36	9 18	25	79
Courtney, M. E.	26	9	9	36	9 17	25	79
Rowe Bros.	29	9	9	34	8 3	20½	72½
Bull, E.	30	8	10	36	6 13	16½	70½
Balharrie, A. S.	28	9	9	37	6 17	17	72
Orr, W. C.	30	8	9	38	5 4	12½	67½
Orr, F. S.	30	7	9	38	5 17	14½	66½
Lynch, T.	30	6	9	37	5 7	13	65
Pearce, R.	29	8	10	36	4 3	10½	64½

The average weight of crop in this Competition was 9 tons per acre.

During the past three years, 1929 to 1931 inclusive, the average results obtained at Musk were—

	tons	cwt.	qr.
No manure	3	14	1
3 cwt. super. per acre	4	9	1
3 cwt. super. and 1 cwt. ammon. sulph.	5	14	2

The second and third dressings gave increases of 20 per cent. and 54 per cent. respectively over the no-manure for the three years.

At Wheatsheaf the average results for the same period were—

	tons	cwt.	qr.
No manure	2	10	2
3 cwt. super. per acre	3	16	0
3 cwt. super. and 1 cwt. ammon. sulph.	4	9	2

The percentage increases over no-manure were 50 and 78 per cent. respectively.

Tuber damage from disease was negligible, but in a few of the crops Rhizoctonia affectation was pronounced in the foliage. This can be easily controlled by the formalin treatment (1 lb. formalin to 20 gallons of water for 1½ hours).

Details of the awards in the three competitions are given in the accompanying tables. In each case the points allotted for weight are *pro rata*, the heaviest crop receiving the maximum of 40.

THE "ROWE" CUP.

Name.	Rows per Chain.	Cleanness.	Evenness.	Quality.	Weight.	Points for Weight.	Total.
Maximum Points	—	**10**	**10**	**40**	—	**40**	**100**
					T. C.		
Balharrie Bros.	28	9	9	34	16 17	40	92
Pardon, J.	30½	9	9	34	15 18	38	90
Courtney, M. E.	25	9	9	34	12 1	28½	80½
Quine, J.	28	9	9	37	9 15	23	78
Bolton Bros.	30	9	9	35	9 10	22½	75½
McCormick, J.	27	9	8	34	8 8	20	71
King, J. M.	29	9	9	35	7 2	17	70

All of the varieties entered in the Rowe Cup were Snowflakes, and the seven entries averaged 11 tons 7 cwt. per acre.

Young Farmers' Clubs

ONE of the very active Young Farmers' Clubs of the State is that at Myrtlebank, near Sale, which is conducted by the local teacher, Mrs. Whitelaw. Local residents have shown a great interest in it, and at a recent meeting it was announced that three calves had just been presented to the club.

At the last Sale show, one of the members was awarded first prize for a pig entered for competition. The young owner gives the following particulars of the feeding, &c., of the pig:—

My father gave him to me when he was eight weeks old; he was a Middle York; I called him "Pete."

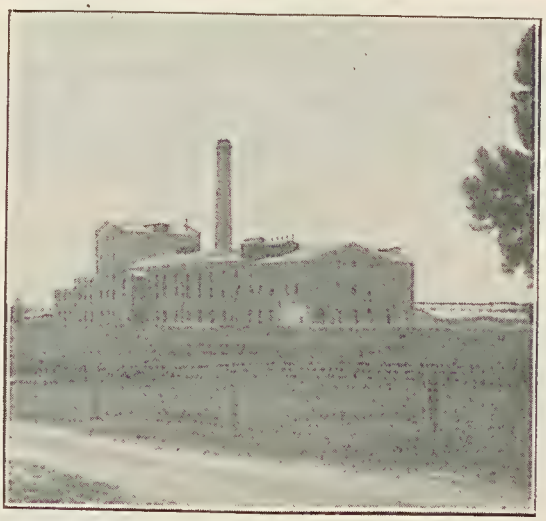
I fed him every night and morning with skim milk and pollard, and later, when I started to fatten him, on crushed barley. I also gave him charcoal and ashes for mineral food. I saw that he had a good bed of straw, and let him out for a run sometimes. Every Saturday I cleaned his sty out.

I was very pleased when he won first prize at the Sale show in November. We sold him a fortnight later for £2 12s. 6d. His food cost £1 6s. 9d., so we made a profit of £1 5s. 9d.

Beet Sugar Industry

Operations at Maffra

By W. L. Williams, former Manager, Beet Sugar Factory, Maffra.



The following article is published as an addendum to Bulletin No. 40, which describes the beet sugar industry in Victoria and sets out particulars of the operations of the Beet Sugar Factory at Maffra up to and including the season 1923-24. This article brings up to date the figures and other information in the Bulletin, copies of which may be had on application to the Director of Agriculture. The price of the Bulletin is 5d., including postage.

IN the 1924-25 season Maffra district growers harvested 1,897 acres for 24,468 tons of beets, yielding 3,017 tons of sugar. The price paid for beets was 40s. per ton. A normal season was experienced, but wet conditions during the harvesting period modified the sugar extraction. The manufacturing account includes a substantial amount for the over-run of the 1923-24 season. After allowing interest and depreciation, the balance-sheet showed a profit of £23,141 19s. 4d.

In this year reconstruction of the machinery and plant was commenced.

Liabilities at 30th June, 1925.

	£	£
Capital, &c.		104,076
Profit and Loss Account	52,494	
Profit for year after interest and depreciation	23,142	
		75,636
		179,712

Assets at 30th June, 1925.

	£
Land, plant, equipment, &c.	51,803
Treasurer of Victoria	28,945
Debtors, &c.	7,091
Stocks	91,873
	179,712

In 1925-26, 1,880 acres were harvested for 21,194 tons of beets, which yielded 2,315 tons of sugar. The price paid for beets was 40s. a ton. A dry and rather difficult season was experienced and sugar results were below average. After charging interest and depreciation, there remained a profit of £3,529. During the remodelling operating costs were necessarily high.

Liabilities at 30th June, 1926.

	£	£
Capital, &c.		170,036
Profit and Loss Account	75,636	
Profit for year after interest and depreciation	3,529	
		79,165
		249,201

Assets at 30th June, 1926.

	£
Land, plant, equipment, &c.	112,730
Treasurer of Victoria	76,958
Debtors, &c.	7,602
Stocks	51,911
	249,201

2,024 acres were harvested in 1926-27 for 9,851 tons of beets, yielding 1,177 tons of sugar. The price paid for beets was 40s. per ton. A drought season was experienced and the crops generally were disappointing. After charging interest and depreciation on old capital, but not on the new, a profit of £855 7s. was shown.

Reconstruction was practically completed. From this period the beets sliced were weighed into the diffusion battery, giving a lower weight than the beets purchased, due to losses by evaporation, tailings, weeds, &c. A common average loss from purchased to sliced beets would be about 5 per cent., but this varies with the season and condition of the beets.

Liabilities at 30th June, 1927.

	£	£
Capital, &c.		189,767
Profit and Loss Account	79,165	
Profit for year after interest and depreciation	855	
		80,020
		269,787

Assets at 30th June, 1927.

	£
Land, plant, equipment, &c.	129,148
Treasurer of Victoria	97,995
Debtors, &c.	4,896
Stocks	37,748
	269,787

In 1927-28, 2,353 acres were harvested for 25,439 tons of beets, yielding 2,349 tons of sugar. The price paid for beets was 42s. 6d. per ton. Owing to abnormal falls of rain in February and March root-rot developed, and the sugar content was very low, 12.56 per cent. This was responsible, after charging interest and depreciation, for a loss of £6,948 15s. 7d.

Remodelling expenditure was adjusted to bring capital into line with the value of assets by deducting the whole of the depreciation to date £51,618, plus £21,552 from profits, or a total special reduction of capital by £73,170.

Liabilities at 30th June, 1928.

	£	£	£
Capital, &c.			119,412
Profit and Loss Account		80,020	
Less Loss for year after interest and depreciation	6,949		
Less Remodelling charged as maintenance	21,552		
		28,501	
			51,519
Treasurer of Victoria			10,050
			180,981

Assets at 30th June, 1928.

	£
Land, plant, equipment, &c.	106,726
Debtors, &c.	4,255
Stocks	70,000
	180,981

In the 1928-29 season 2,130 acres were harvested for 15,236 tons of beets, yielding 2,108 tons of sugar. The price paid for beets was 43s. per ton. The season was very dry and acreage yields low, but a high average sugar content enabled the factory to pay a good price for beets and show a profit of £5,653 10s. 1d. (Depreciation will now be reserved, and not deducted from assets as formerly.)

Liabilities at 30th June, 1929.

	£	£
Capital, &c.		117,428
Profit and Loss Account—		
Balance	51,519	
Repair provision	2,000	
Profit for year	5,654	
		59,173
Depreciation reserve		3,932
		180,533

Assets at 30th June, 1929.

	£
Land, plant, equipment, &c.	106,803
Debtors, &c.	4,938
Stocks	64,083
Depreciation Fund	3,932
Treasurer of Victoria	777
	180,533

In 1929-30, 2,500 acres were harvested for 26,525 tons of beets, yielding 3,472 tons of sugar. The season extended into July, so that 599 tons of the sugar belong to the next balance-sheet period. The beets averaged 17 per cent. of sugar, and the price paid to growers was 44s. per ton generally, and 46s. for screened beets. The season was dry and disappointing in the early stages, but it finished up quite favorably to growers and the factory. The sugar manufactured to 30th June resulted in a profit of £17,341 5s. 4d.

Liabilities at 30th June, 1930.

	£	£
Capital, &c.		117,334
Profit and Loss Account—Balance	59,173	
Profit for year	17,341	
		76,514
Reserve for depreciation		7,715
Treasurer of Victoria		8,249
		209,812

Assets at 30th June, 1930.

	£
Land, plant, equipment, &c.	106,773
Debtors, &c.	2,661
Stocks, &c.	92,663
Depreciation Fund	7,715
	209,812

Over 3,000 acres were planted to beets in 1930-31, and conditions were favorable for a record crop.

An analysis of the profit and loss account to date shows the following results:—

Year.	Capital.	Receipts, including Increase or Decrease in Stock.	Expenditure.	Profit.	Loss.
	£	£	£	£	£
1912–13 .. (6 months)	76,416	14,557	18,136	..	3,579
1913–14 ..	79,432	22,630	32,935	..	10,305
1914–15 ..	79,520	28,766	31,552	..	2,785
1915–16 ..	78,682	22,406	25,595	..	3,189
1916–17 ..	81,391	54,510	46,496	8,014	..
1917–18 ..	81,708	53,346	51,478	1,868	..
1918–19 ..	82,068	41,360	43,142	..	1,782
1919–20 ..	82,354	72,792	56,043	16,749	..
1920–21 ..	83,614	49,999	44,723	5,276	..
1921–22 ..	83,732	77,123	67,203	9,920	..
1922–23 ..	87,443	97,231	83,940	13,290	..
1923–24 ..	93,421	105,179	86,162	19,017	..
1924–25 ..	99,906	134,012	110,870	23,142	..
1925–26 ..	165,809	97,182	93,653	3,529	..
1926–27 ..	187,693	62,042	61,187	855	..
1927–28 ..	117,264	89,551	96,500	..	6,949
Remodelling Adjustment from Profit			21,552	..	21,552
			971,167	101,660	
Repairs Reserve Transferred to Profit			— 2,000	+ 2,000	
			969,167	103,660	
1928–29 ..	117,341	78,031	72,377	5,654	
1929–30 ..	117,311	107,296	89,955	17,341	
..		1,208,013	1,131,499	126,655	50,141*
Deduct Losses and Remodelling Adjustment				50,141	
Net Profit at 30th June, 1930				76,514	

* Includes Remodelling Adjustment.

Note.—In 1925 the wholesale price of sugar was £37 10s. per ton. Since then it has been £37 5s. per ton.

Irrigation.

Irrigation water has been available to many beet-growers during the last few seasons. While numerous good crops have been grown under irrigation, some have been disappointing, and many lessons are yet to be drawn from experience before any very definite rules can be declared for irrigating sugar beets in the Maffra district. It is certain that special care and much thought are required when irrigating this deep-rooting plant. At first there was a natural tendency to let loose too much water on the beet areas, and sometimes even to flood them. This was rarely satisfactory, and it is clear that three or four waterings, each of 4 to 6 inches, according to the season, are far better than one excessive watering. It is safer for the beet plants, better for the soil fertility, and

Cultivating the Young Beet Crop.

helps to maintain a steady growth over a longer period.

Slow watering also has been a cause of trouble. The beet soils are deeply cultivated and, if not properly graded and furrowed, slow watering may cause the soil, especially the subsoil, to become saturated for long periods, and so rot the taproots of the beets. Rapid and well-regulated irrigation is essential; therefore, a good flow of water and a good furrow system are desirable, so that any surplus water may be kept moving and carried forward. In the early stages of irrigation it was seldom possible to grade properly, and the water frequently drifted into the low-lying sections, leaving the ridges ill-watered while the depressions were over-watered. The result was that the most promising of the beets rotted. The remedy for this is grading and furrowing.

Throughout the irrigation areas there is a general tendency for surplus water to drift towards and along a low-lying, indifferently-drained section, and at times the sub-soil therein becomes saturated. The excessive saturation has made the sub-soil cold, damp, and acid, and as the sugar beets are deep-rooting plants their growth has been arrested, and root-wilt and root-rot have developed. The remedy is to sweeten the soil by drainage, aeration, and the addition of lime and humus. The State Rivers and Water Supply Commission already has opened up one large main drain, and growers will find it necessary to grade and drain their beet areas to this outlet.

Where the under-drainage and the surface drainage are good, experience shows that irrigation may be applied with safety, and good crops may be looked for. Good drainage accounts for many excellent crops on the second-class lands, on which only poor beets would be grown without irrigation. The benefits from irrigation on well-drained and graded areas are self-evident, and the difficulties on other areas are mentioned in order that they may be carefully considered and remedied where possible.

Just as any substantial building is unsafe without a good foundation, so is the deep-rooting beet crop under irrigation unsafe without good drainage. In other words, drainage is fundamental, and if unsatisfactory, then irrigation should be deferred pending correction. This implies drains, grading, furrowing, quick application of the water, and bays or sections of such size that the head of the bay may not become waterlogged while the far end is barely moistened. If, by bad drainage or excessive irrigation, a section is over-watered and the beets wilt, it is quite likely that the trouble will recur the following season. The soil should be cultivated as soon as possible after every irrigation, in order to aerate the soil, protect the humus, conserve the moisture, prevent hardening of the soil, and promote growth.

With irrigation and intense culture it is very evident that rotation is necessary to maintain fertility and to correct any faults due to irrigation, such as reduction of humus and accumulation of mineral salts. The system of rotation should be determined by local possibilities and the growers' own farming and marketing plans. Beets should, if possible, be preceded by a leguminous crop such as clover, lucerne, peas, or beans. Hay or grain crops give notably high yields following beets.

Production Statistics.

The world's sugar production since 1923-24 has been as follows:—

Year.	Cane.	Beet.	Total.
	Tons.	Tons.	Tons.
1923–24 ..	14,570,536	5,793,750	20,364,286
1924–25 ..	15,829,464	7,952,679	23,782,143
1925–26 ..	16,811,607	8,144,643	24,956,250
1926–27 ..	16,154,464	7,542,857	23,697,321
1927–28 ..	16,500,893	8,737,500	25,238,393
1928–29 ..	17,908,928	9,076,786	26,985,714
1929–30* ..	17,326,786	8,806,250	26,133,036

* Estimated.

Australian figures for the same period are—

Year.	Production.	Consumed and Carry-over.
	Tons.	Tons.
1923–24	386,004	261,920
1924–25	435,818	346,073
1925–26	517,970	292,168
1926–27	415,876	326,891
1927–28	509,094	337,742
1928–29	535,131	335,875
1929–30*	520,000	325,474

* Estimated.

Marketing of Citrus Fruits

By J. M. Ward, Superintendent of Horticulture.

THE marketing of citrus fruits is a subject that can be discussed from many angles, and is one that requires attention by those skilled in marketing methods and the handling of such fruits. I do not intend, therefore, in this short discussion, to deal with every aspect of the business, but merely to put forth a few points as I see them and as seen by others who have interested themselves in citrus fruits.

The marketing of these fruits does not commence when the article is placed on the market, although, unfortunately, there are many people who consider that this is the beginning of marketing. Even those who have been selling fruit to the retailer for many years are not necessarily authorities upon marketing methods.

The cost of marketing citrus fruit, indeed, of all fruit, is very high. One cannot blame any particular party for the present system; it is a practice that has been brought about by both growers and agents, and it is as much the fault of one as it is of the other. The way things are at present, every grower has tried to become an authority on marketing; and marketing by individuals necessarily has become expensive, because too many are "getting a cut out of it."

Almost every grower has a small packing and case-making plant; this means the unnecessary outlay of capital. Even with small district packing houses, the cost of packing is too great, that is, when overhead costs and the comparatively small area served are taken into consideration. The erection and operating of small district packing sheds have been encouraged in the past, but it has been found by experience that these do not pay, and are not giving satisfaction to those concerned. One reason is that, were they to install modern equipment for grading, proper washing, and mould control, the cost of packing a case of fruit would be out of all proportion to the price received. Every citrus-grower knows—or should know—that marketing of fruit begins in the orchard, actually before the fruit is on the trees. District, soil, and cultural practices play an all-important part in marketing.

A number of those engaged in the industry recognized that a considerable amount of investigation was needed in connexion with the handling and storing of citrus fruits, more particularly oranges, and after collaboration a committee was appointed to make the necessary investigations. The Council for Scientific and Industrial Research, the Victorian Department of Agriculture, the Railway Department (the largest buyers of citrus fruits in Victoria), and the growers, through the Victorian Central Citrus Association, are represented on this committee, which is known as the Citrus Preservation Research Committee. This body has carried out most valuable work, reports of which have already been published. One important discovery made was that the best keeping results were obtained from oranges carefully harvested in Mildura (350 miles from Melbourne), loosely packed in boxes at the tree and forwarded to Melbourne, where they were processed, packed, and stored.

The result of these investigations makes one realize the waste of energy and expense that is taking place in the various citrus districts in putting the fruit up ready for market. This waste could be avoided by forwarding the fruit direct from the trees to one large central packing house in Melbourne, situated at or near a cool store, and this would enable the management to install up-to-date appliances and train an expert staff for handling the fruit. A large quantity of fruit going through the one channel would be handled at a more economical rate, and the market could be more easily controlled.

At the present time, the best use is not made of cool storage facilities. Often fruit is sent down to be sold, but, owing to the state of the market, is put in cool store for some days by the agent, or, in many instances, is kept in the agent's store at whatever temperatures prevail at the time. Under certain conditions of

temperature and humidity, a rapid deterioration occurs. Again, if the fruit is put in cool store, two alternatives confront us:—

1. If the fruit has not had the very careful handling necessary to enable it to stand up to long storage, it can be put in at 35° F., a fairly low temperature designed to keep mould growth to a minimum, but the fruit should not be left in store too long, owing to the fact that browning of the skin, and the development of a bitter flavour, are likely to be encountered at this low temperature.

2. If the fruit has been carefully handled, it will stand up to longer storage, and in this case 38° F. is the better temperature to use. Browning of the skin should be much lower than at 35° F., and the bitter flavour should not develop for a considerable time.

On the other hand fruit liable to mould attack would develop mould much more quickly at 38° F. than at 35° F. Thinking they are acting in the best interest of their clients, agents often put fruit in cool store for a short period. In such a case the cool-store people usually put it in at 35° F. on the word of the agent that it will not be in long, as this is the best temperature for this class of storage. Owing to market factors, it sometimes has to be left in longer than at first expected, and develops browning, and often bitterness. Had the cool-store authorities known that the fruit was to be in for some weeks and had been carefully handled, the temperature chosen would have been 38° F.

A central organization on the lines suggested would be in a position to control the market much better than at present, although in this respect the Victorian Central Citrus Association is doing good work. Its officers are alive to the situation, but require the strongest backing possible from the growers. The best use could also be made of cool storage facilities by means of which, as the work of the Citrus Preservation Research Committee has shown, the local market can be supplied all the year round.

The foregoing suggestions are put forward in the hope that those who are in a position to do so will give the matter the necessary consideration, with a view to bringing about an improvement in the marketing of our citrus fruits.

While on the subject of marketing, I would like to refer to the possibility of serious attacks on oranges during the coming season by blue and green moulds. Most of those handling citrus fruits are careless in their attitude to moulds. In damp seasons such as experienced last year, and this year so far, it is essential that growers, in the first place, should take steps to control moulds at the orchard end; and at frequent intervals (practically daily) picking boxes, buckets, bags, graders, floors and walls of packing sheds; in fact everything that comes in contact with the fruit cases, &c., should be sprayed with formalin at the rate of 1 pint of formalin to 5 gallons of water. Second-hand cases before being used should always be so treated or sterilized by steaming or otherwise.

Agents in the markets and retail fruiterers also should take similar action in their stores, &c., and thus minimize the great loss that occurs through mould attacks. All mouldy fruit should be destroyed by burning or equally effective treatment. In short, growers and others who handle citrus fruit cannot be too careful, and the greatest of care should be exercised in handling the fruit, so as not to injure the skin in any way, thus allowing the spores of moulds to gain access to the fruit. Without skin injury, mould damage is rare. Pickers, packers, and nailers-down are the ones usually responsible for skin damage, and are therefore largely responsible for losses by moulds.

Book Received

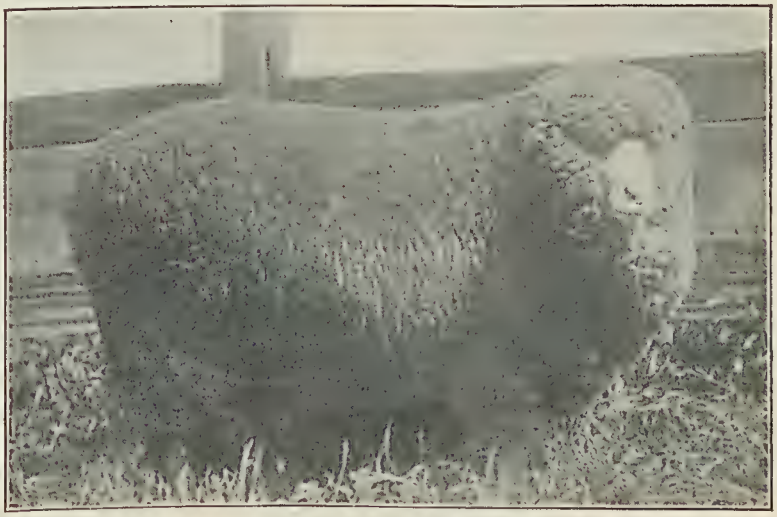
Report of Proceedings of the Fourth World's Poultry Congress, 1930, 1023 pp. The many papers read at the Poultry Congress in London in July of last year, at which representatives of 60 nations were present, are printed in this report. In addition, it includes reports of the discussions among delegates on the various subjects dealt with. There is an excellent index which makes the work a valuable work of reference. Copies are obtainable direct from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2, or they may be ordered through a local bookseller. The price of the report is 10s. 6d. net; thus it would probably cost about 15s. in Australia.

Sheep-Breeders' Field Day

Points of the Corriedale

Report compiled by N. A. Bowman, Sheep and Wool Expert.

A FEATURE of the annual field day held recently by the Ballangeich and Ellerslie Sheep Farmers' Association was a talk by Mr. S. H. Moreton, of Lake Bolac, on the history of the Corriedale. Mr. Moreton, who illustrated his lecture by means of demonstrations with a number of his own stud and flock Corriedale sheep, stated that the breed originated in 1867 when the late H. T. Little, of Corriedale Estate, in the Canterbury district of New Zealand, mated pure Merino rams with pure Lincoln ewes. His object was to obtain a definite type of sheep midway between these two old-established breeds, and it was only fitting that the successful breed that resulted should have been named after his estate. However, it was not until 1874 that the breed made much headway. In that year the New Zealand and Australian Land Company started its "Levels" flock, which also was of Merino-Lincoln foundation. From then on Corriedales made rapid progress in New Zealand, but they did not come prominently before Australian sheep-breeders until some twenty years ago; although, as early as 1882, Mr. H. H. Corbett, then of "Woodpark," near Penshurst, Victoria, had mated Mr. J. L. Currie's pure Merino rams with the late Dr. Brown's pure Lincoln ewes and produced a type of sheep that appealed to many breeders.

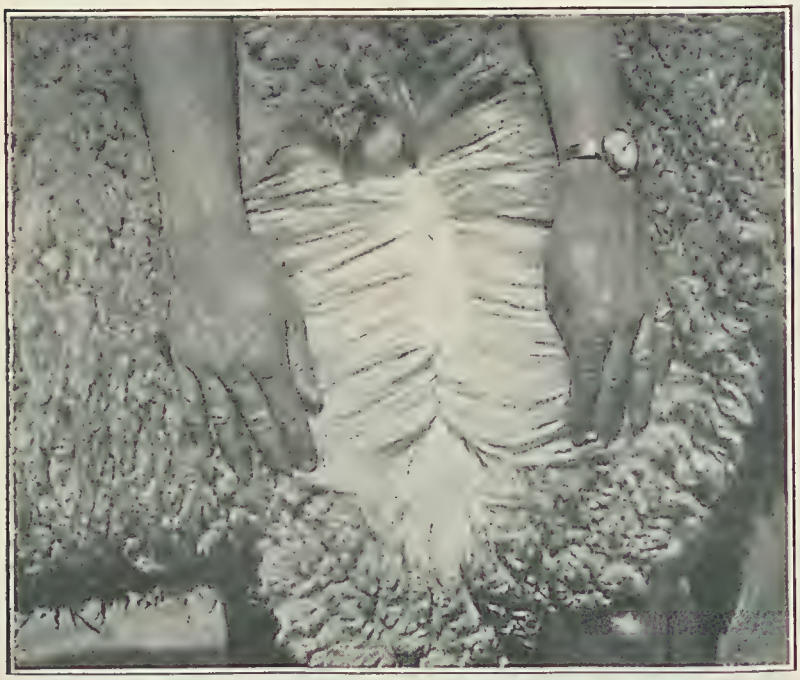


Typical Corriedale Ram.

In 1913 sufficient breeders were to be found in Australia to warrant the formation of an association which was called "The Australian Corriedale Sheep-breeders' Association." After several years of fighting against adverse criticism, the association began to make headway, and during the past five years the membership has increased by over 100 flocks. Two years ago a Victorian branch was established.

Early in the history of the Australian association it became evident that a controlling hand was necessary to ensure an even type of sheep, and inspectors were appointed to inspect, each year, all sheep eligible for the flock book, only those up to standard being passed. As each sheep passed by the inspectors is tattooed with a "C" in the ear buyers, by stipulating that each sheep shall bear the registered mark, may avoid purchasing unregistered or nondescript Corriedales. In spite of this precaution, quite a number of unregistered and nondescript rams have been used, a fact which has caused considerable harm both to the good name of the Corriedale, and the would-be Corriedale breeder.

Discussing the future of the Corriedale, Mr. Moreton contended that the breed was here to stay. It was a notable fact that no registered breeder of Corriedales had disposed of his flock through any dissatisfaction with the breed. In Australia very little attention had been paid by breeders to competing with other



At the Shoulder.—Good wool, showing length, style, and density.

sheep in the fat pens or in the "value of wool" classes; but when it had been attempted, the results, practically without exception, had been most gratifying. Indeed, at the Sydney Sheep-breeders' Show last year the Corriedale wether was supreme over all comers, both in single and group competition. The claims of the Corriedale were manifold. After years of experience with the different crosses, he had found that they were very strong constitutioned sheep, carrying a dense even quality of fleece, which, of latter years, has been much sought after by the trade. Credit must also be given them for their ability to supply the ever-increasing demand of the present day for young mutton, for it was a well-known fact that they were readily fattened at one or two years old. This fact, coupled with the enhanced value of a heavily woolled skin, was a serious factor in their favour in these times of depression when a quick return was appreciated.

The Corriedale cross sheep, being of a quiet disposition, are just as much at home whether running on a farm or a big sheep run. They do not feed in mobs as Merinos do, but graze contentedly, evenly distributed about the paddock, and although nearly twice as big as the average Merino, will run acre for acre with them. They are particularly adapted to fossicking for food and will help to eradicate such weeds as horehound, cottonbush, &c., and will fatten on the flower of the Scotch thistle during the dry time of late summer.

The practice of using the Corriedale sire on the Merino to produce a comeback in one cross is fast becoming general, and it is in this direction that a great number of Australian sheepmen are looking. The further extension of this practice should help the small breeder of crossbred sheep, since there would be fewer classes of wool to contend with and much less space necessary in handling the clip.

Even Covering from Shoulder to Rump.

(Continued on page 354.)

Clean Milking

By N. R. Trewin, Dairy Supervisor.

THE first essential in the production of choicest grade dairy produce, whether it be milk, cream, or butter, is cleanliness; and under the present unfavorable economic conditions, with the low ruling prices for all farm products, anything but the highest quality article will yield but little profit.

It is pleasing to notice the great number of up-to-date dairy premises with impervious, concrete floors, excellent sanitation, and almost all necessary conveniences for facilitating the work, but important as these improvements undoubtedly are, yet they are not of very great value if the simple rule of cleanliness is not strictly adhered to. A better article can be produced in mean surroundings where scrupulous cleanliness is observed than in the most modern premises where carelessness and neglect obtain.

To-day the majority of dairy farmers, fortunately, do observe reasonable care and cleanliness in the manufacture of their produce, but even on many of the best farms where the premises are generally kept in splendid order, there is often inadequate care in milking. By many this is considered too unimportant a point to seriously contemplate, and milking methods that can be described only as dirty are common. If the milk be contaminated as it is drawn from the cow, all the subsequent care and attention will be of little avail.

Deterioration of milk or cream is brought about by bacterial action. These bacteria, or germs, gain access to the milk in various ways, but most frequently through the medium of dirt, in some form or another, getting into the milk. The germs multiply very rapidly in a suitable temperature, and the temperature of milk or cream which has not been cooled is an ideal one for their propagation. The germ becomes elongated, then breaks in two, thus forming two in place of one. This change may take place every twenty minutes in a favorable medium luke-warm milk or cream; therefore, even one germ, in 24 hours, would increase to many millions.

If milk could be kept entirely free from bacterial life it would keep for a very long period. It is, of course, impossible to keep milk wholly free from infection, but care should be taken to minimize the risk of impurities finding their way into it, and the importance of clean methods cannot be too strongly emphasized.

There are two ways of milking, by hand and by machine. Equal care is required for both, but with the machines there is the additional care involved of keeping them absolutely clean, for which purpose a liberal supply of boiling water and caustic soda is needed.

Actually there are two methods of hand milking, known as the "wet" and the "dry." The former cannot be too emphatically condemned. If too much moisture is applied to the teats, filthy drops will form on the hands, and go thence into the bucket, introducing innumerable bacteria, besides leaving infected matter on the skin and hair to contaminate the next milking. This will happen even if the udder be previously washed. "Wet" milking also has a tendency to cause cracked teats.

With "dry" milking there are no filth drops to contaminate the milk. Further, cows "give" their milk more freely under this system, and not so much stripping is required. If "dry" milking were generally adopted it would result in a much cleaner and purer milk supply.

When the cow is bailed up, prepare her for milking by brushing any loose hair and dust off her flanks and hindquarters. If this is not done, some hairs are bound to fall into the bucket, and each one will introduce a number of germs; then wash the teats and udder with clean water. The hands of the milker should be washed after milking each cow. It is frequently said that in fine weather, the teats are not dirty, and do not require washing. Even though there is no mud on them, there is certain to be an accumulation of dust and scurf, and this must at least be wiped off with a clean, damp rag.

If any cows in the herd be suffering from mastitis, or sore teats, a little odourless disinfectant, such as Condy's crystals, should be added to the water; this will prevent the trouble spreading.

Every cow-shed should have a plentiful supply of water laid on; where this is not done, it is well to have an oil drum, with a tap near the bottom, or a small discarded milk vat, on a raised platform, so that the milker, when washing his hands and the cloth used for cleansing the cows' teats, may hold them under running water. This would ensure only clean water being used. Often a small tin of water is used in the cleaning of a number of cows, with the result that probably after a while more dirt is being put on the udder than is taken off.

Immediately after milking, the milk should be put through a good strainer of proper design and principle, possessing no untinned iron edges, which inevitably rust, nor dents and cracks, that are at least difficult to clean. The old one-piece strainer should be discarded. The only really effective and sanitary straining principle is that which relies on a straining gauze, which is both very closely woven and renewable. The best yet seen has cotton-wool wafers set securely between finely perforated metal plates of a non-corrosive nature. One cotton wool insert usually will suffice for a whole milking, and should then be discarded. The makers of such strainers supply the pads by the gross at a cost of about ½d. each. The superior efficiency of the principle makes it well worth while. The cotton wool dispenses with the common fine wire gauze, which, unfortunately, must be too fine to be easily cleaned, if it is to be fine enough to strain effectively.

Sheep-Breeders' Field Day.

(*Continued from page* 352.)

Points of the Corriedale.

Dealing with the main points of the breed, Mr. Moreton said that the Corriedale should give one the impression of being a well-turned, balanced sheep, with a remarkably hardy constitution, together with "a bundle of wool" appearance. He stressed the need for remembering the dual purpose points of the breed, carcass and wool, not one without the other.

The head should be hornless, broad, well-woolled, but free from bad wool blindness. Black or blue spots on the ears were no defect, and wide open nostrils, preferably black, were preferred. The neck should be nice and strong, forming a good scrag, and the back level and broad and of good length; brisket well let down; and ribs well sprung and deep, and hindquarters nicely turned giving a good meaty appearance. A Corriedale should carry a heavy, even fleece, of good length, dense stable, pronounced crimp and an even tip. The wool should be of a 50-56s. quality, and of a good bulky type—a good bale filler.

Mr. Moreton concluded his talk by stressing the importance of purchasing rams, no matter of what breed, from registered flock owners. If every sheepman, large and small, would do this the flocks of the Commonwealth would be very much improved in evenness, length of staple, &c.

Following Mr. Moreton's talk, a judging competition was conducted with Border Leicester rams. Ten rams were selected and the one who placed the first five correctly was declared the winner. The prize went to Mr. W. Ryan. While the judging of the Border Leicester rams was in progress Messrs. A. W. Dennis and Urquhart Ramsay were busy awarding prizes in the two classes opened this year for members' sheep:—

(1) Pen of three Polwarth type ewes;

(2) Pen of three Corriedale type ewes.

The prize in the Polwarth section went to Mr. R. Ormsby, and in the Corriedale section to Mr. J. Ryan.

Verrucose Dermatitis or "Grease" in Horses

By S. A. Mountjoy, Veterinary Officer.

THE term "grease" is used to designate an inflammatory disease which starts about the posterior part of the pastern, and may extend to the knee or hock. The name originates from the fatty nature of the discharge from the oil glands of the skin, which collects round the injury.

Cause.

The immediate cause is as yet unknown.

The following are some of the contributing causes of the condition:—Grit and dirt; cold, damp or wet; scratches or slight grazes. In dirty stables the action of dung, liquid manure urine, &c., is very liable to bring on the disease.

The hind limbs are the more liable to become affected, being more exposed to the action of dung, &c. Washing the limbs and *not thoroughly drying* them is another contributing factor. Mud should be left on until dry and then brushed off.

The disease may be transferred from an affected leg to a sound one by rubbing.

Symptoms.

The disease is progressive, and may become chronic if not suitably treated at its earliest stage. It may start in a small area below the fetlock at the back of the pastern, and gradually extend until it involves the limb up to the knee or hock. A larger area may be attacked at the outset. The skin in the region becomes reddened, thickened, and moist, and may become itchy.

As the disease progresses there is an active proliferation of the cells of the skin, which break down and form a fatty evil-smelling grey mass on the surface. The papillae of the skin increase in size and appear like large warts. The deeper layers may become affected and cause marked thickening of the affected region. Most of the hairs drop out, and those that remain stand erect.

The amount of lameness varies according to the severity of the condition.

Treatment.

Spontaneous recovery is rare. Even slight cases need careful and prolonged treatment, and this should, if possible, be carried out under instructions from a qualified veterinary surgeon. When the disease is extensive, with much thickening and "grape" formation, treatment becomes much more difficult, and surgical interference is often necessary.

Treatment should commence with a dose of physic, such as 1 to 1½ pints of raw linseed oil given by way of the mouth, or an aloes physic ball. The grain ration should be stopped, and plenty of green feed and bran mashes, to which 2-oz. doses of Epsom salts may be added, given in its place.

In the early stages clip the hair from the affected part, thoroughly wash the leg with soap and water containing washing soda—one teaspoonful to the pint—after which the leg should be thoroughly dried. The affected skin should be dressed with the following lotion twice daily:—Liquor plumbi subacetatis 1 oz., methylated spirits 8 oz., water 1 quart.

More advanced cases should be treated as follows:—Liquor ferri perchloridi fort should be gently rubbed into the affected area by means of a piece of tow wound round a stick. The dressing should be applied every three or four days at first, and later on once a week.

Should this treatment after a time in very obstinate cases seem to lose its effect, a drying powder, consisting of equal parts of boric acid, powdered lime, and common salt, may be rubbed by hand into the affected part daily for a week or so; the iron treatment may then be resumed.

The leg should be kept thoroughly dry; therefore, the application of water must be avoided, and the parts cleansed by rubbing with clean cotton waste.

Treatment should be continued regularly until all discharge has ceased.

Orchard and Garden Notes

By Edward E. Pescott, F.L.S.

The Orchard.

THE time is approaching when control measures for the suppression of pests and diseases should be adopted for the coming season. All pruning will have been completed by the middle of August, and the trees will soon show signs of growth.

Where trees are attacked by scale insects, spraying should be done after pruning and before growth begins. Any contact spray which includes either oil or nicotine is useful; white oils such as volck are the ones most successfully used. Such a spray will eradicate all scales, aphis, and mite pests.

Where woolly aphis is abundant, application should be made to this Department for a supply of the Aphelinus parasite, which will clean out this pest.

Apple trees should be sprayed for black spot; the time of application seems to be more important than the components of the mixture, although Bordeaux and lime sulphur are the two safe outstanding sprays. Two sprays are necessary, the first when the blossom buds are showing a colour of pink; this is called the "pink stage"; the second spray should be applied when the flowers of the clusters are fully open. A leaflet on this disease is issued by the Department of Agriculture.

Phlox Drummondi.

The Flower Garden.

Preparation should now be made for the sowing of seeds of summer annuals, and for the planting of Gladiolus corms for early summer flowering. The seed bed should be well dug over, and it should be composed of a light loamy soil. If the soil be at all heavy, it should be made light and free by the addition of sand and leaf mould. The seed should not be sown for two or three weeks after the preparation; this allows for a germination of weed seeds. When these are cleaned out, the flower seeds may be sown, say, about the middle of August. Seeds to be sown are Aster, Zinnia, Phlox, Sunflower, Marigold, Calendula, Salvia, Calliopsis, Didiscus, Gaillardia, Scabious, and Carnation.

In preparing the soil for Gladiolus corms, it should be dug to the full depth of the spade, placing some old animal manure, or a handful of bonedust below the corms. The corms should be set in a well-primed soil with the tip 3 inches from the level of the garden. The corms should be sprinkled well with Cliff's Manurial Insecticide before planting, so that they shall be safe from attacks of bulb mite.

The Vegetable Garden.

Have all beds well dug over, green manure or stable manure well turned in, and the soil well trampled and made firm for planting. In the seed beds, seeds of tomato, pumpkins, marrows, melons and cucumber may be sown for future transplanting. The seed bed should be kept warm; and during cold nights it may be covered with hessian frames.

In the garden beds, seeds of green peas, broad beans and lettuce may be sown. These are sown in rows. The lettuce should be sown thinly, and when the plants are sufficiently advanced, the row should be thinned out, leaving a plant every two or three inches. The seedlings thinned out may be used for transplanting, thus providing a second crop.

When peas and beans are sown in the rows, they should be given a good dusting of slaked lime before covering with soil. This keeps away many small soil pests that would prey on the germinating seeds.

Asparagus beds should be cleaned from weeds and top dressed with well-decayed manure. Rhubarb plots should be similarly treated. Sowings of artichoke tubers may now be made; the smoother and more shapely tubers should be chosen.

Professional Papers

[This section is devoted to professional papers and articles of a scientific character.]

Chemical Studies of Pasture

[1. *Effect of rate and frequency of watering on chemical composition and nutritive value of frequently cut samples of irrigated mixed pasture.*]

W. R. Jewell, M.Sc., F.I.C., F.A.C.I., Agricultural Research Chemist.

FOR a number of years past permanent pasture plots under irrigation have been conducted at the State Research Farm, Werribee, to determine the effects of different rates and frequencies of watering on the yield of grass. During 1929-30 these plots were cut at frequent intervals to imitate close grazing, and the yields obtained have already been reported by Mr. L. C. Bartels, B.Ag.Sc., Senior Irrigation Officer (this J.XXVII., Pt. 9, 1930, 563). Samples of the herbage cut from these plots were referred to the Chemical Branch for examination. The main objects of this chemical investigation were: (*a*) to determine if increased yields of grass from certain applications of water were obtained at the expense of the quality of the grass; (*b*) to ascertain if frequently cut irrigated pasture remained "young"; and (*c*) to furnish data on the chemical composition and feeding value of closely grazed, irrigated permanent pastures, the importance of which in economic farming is becoming more and more appreciated in Victoria.

Mr. Bartel's summary showing the yields obtained with various rates and frequencies of watering is reprinted in Table 1, and renders unnecessary any further description of the plots and cuts. Waterings were made at requisite intervals from the middle of October, 1929, until the middle of March, 1930. In addition, monthly rainfall figures were as follow:—

September, 1929	113 points
October, 1929	157 points
November, 1929	214 points
December, 1929	204 points
January, 1930	11 points
February, 1930	218 points
March, 1930	34 points
April, 1930	132 points
May, 1930	319 points
June, 1930	131 points

Plots were cut at intervals of about three weeks, depending on the stand of grass on heavier yielding plots, and representative samples from each plot were forwarded green for analysis in airtight tins. Owing to variations in watering procedure, all plots were not necessarily at exactly the same stage of growth at cutting. In addition to variations in botanical composition, differences would be apparent at certain cuts between slow-growing and rapidly-growing plots, but the frequency of cutting was such that all samples were of "young" pasture.

Analytical Results.

Moisture was determined on the sample as received and a sample dried and ground for analysis. Protein, fibre, silica and silica-free ash were determined by standard methods and fat plus nitrogen-free extract by difference. It was considered unnecessary to determine fat in every sample as a number of analyses indicated that the fat content was fairly constant at about 3.5 per cent. on dry basis, which figure was used in computing nutritive ratios.

Analytical results on each plot are not shown separately, but Tables 2 to 5 show collected figures for protein, fibre, silica-free (or soluble) ash and carbohydrate plus fat respectively, together with the true weighted average per plot for each constituent over the whole period of the trial.

Table 6 is a chemical summary of the total produce from each plot. It shows the total yield in lbs. of the various constituents as well as the weighted average perecentage of each. Column F, showing feeding value as calories per 100 grams, is based on Godden's formula, and while only approximate is a useful method of evaluating fodders in the

absence of accurate digestibility trials. It is probably an accurate and reliable indication of relative feeding value in this case, where all samples were similar to the extent that they were all of young herbage. Column G is an indication of the total feeding value of the produce per plot.

Column H shows the nutritive ratio of the produce from each plot. The first cut of the season was of grass that had been growing for some time during the winter, and was therefore not strictly comparable with subsequent and more frequent cuts. The protein content of first cuts (Table 2) and Column J (Table 6) showing the relatively wider nutritive ratios of Cut 1, are confirmation that grass from this cut was not as young as that from subsequent cuts. Column I was therefore included to show the nutritive ratio of the pasture from the different plots, with Cut 1 excluded. Relative feeding values (calories) were not affected by the inclusion of Cut 1.

In the absence of digestibility trials on this particular pasture, digestible co-efficients obtained by Woodman (Ministry of Agriculture, Misc. Pub. 60, 1918, 20), on young grass were used in calculating nutritive ratios. As one indication of the high feeding value of young pasture it might be of advantage, in passing, to show the high order of the digestible co-efficients as determined by Woodman for young grass compared with those generally accepted for grass in the hay stage.

	Young Grass.	Meadow Hay.
Protein ...	... 83	... 50
Fat ...	... 61	... 50
Carbohydrate	... 86	... 40
Fibre ...	... 82	... 60

Woodman points out that the remarkably high digestibility of fibre in young grass is due to the fact that constant cutting or grazing keeps the grass immature and prevents the thickening or lignification of cell walls. Thus fibre in frequently cut pasture is in the form of simple cellulose, a nutrient of high digestibility, while in mature grass it is relatively indigestible lignocellulose.

Conclusions.

From the data set out in these tables a number of interesting conclusions may be drawn:—

(1) On the whole, the composition of the produce from each plot (percentages in Columns B to E, Table 6) is remarkably similar. This is also expressed in Column F

RATE AND FREQUENCY OF WATERING - SEASON 1929-30.

All Plots Manured with 2 cwt. Superphosphate per acre. Area of plot cut = ⅛ acre.

TABLE 1.

No.	Plot.	Yields of Dry Matter in lb. per Plot.											Total Yield per Plot Green Grass.	Increase over No Water Plot.	Increase per acre-inch of Water.
		1st Cut, 3.10.29 to 9.10.29.	2nd Cut, 31.10.29 to 4.11.29	3rd Cut, 21.11.29 to 27.11.29.	4th Cut, 19.12.29 to 20.12.29.	5th Cut, 6.1.30 to 7.1.30.	6th Cut, 28.1.30 to 29.1.30.	7th Cut, 17.2.30 to 18.2.30.	8th Cut, 10.3.30 to 11.3.30.	9th Cut, 11.4.30 to 12.4.30.	10th Cut, 23.6.30 to 24.6.30.	Total Yield per Plot.	80 % Moisture.		
		lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1	6 waterings of 3" ..	149·18	128·80	61·49	86·28	76·68	64·51	68·62	105·42	54·50	66·0	861·48	4,307·40	2,596·90	144·27
2	6 waterings of 4" ..	174·64	215·62	91·07	117·18	108·3	81·52	94·29	112·47	71·71	76·10	1,142·90	5,714·50	4,004·00	166·83
3	6 waterings of 5" ..	181·0	200·69	96·93	114·89	110·31	66·82	119·20	116·08	63·31	78·40	1,147·63	5,738·15	4,027·65	134·25
4	6 waterings of 6" ..	194·30	233·16	98·59	115·97	111·68	69·63	96·70	120·45	69·34	63·90	1,173·72	5,868·60	4,158·10	115·5
5	No water ..	109·60	45·02	28·25	26·58	27·27	12·77	..	28·75	10·66	53·20	342·10	1,710·50	..	..
6	5 waterings of 6" ..	118·70	194·94	86·46	93·70	47·26	69·10	86·16	119·62	74·24	87·50	977·38	4,886·90	3,176·40	105·88
7	4 waterings of 6" ..	211·40	182·35	87·74	77·29	44·53	55·14	13·00	53·83	62·49	116·50	904·27	4,521·35	2,810·85	117·12
8	3 waterings of 6" ..	125·10	180·68	85·45	59·49	59·67	33·45	40·29	57·66	26·02	85·90	753·71	3,768·55	2,058·05	114·34
9	8 waterings of 3" ..	208·71	145·90	93·90	82·96	83·69	68·52	63·74	93·13	105·02	98·20	1,042·75	5,213·75	3,503·00	146·0

Table 2.—Crude Protein.

Cut No.	Date.	I. (6 of 3″).		II. (6 of 4″).		III. (6 of 5″).		IV. (6 of 6″).		V. (None).		VI. (5 of 6″).		VII. (4 of 6″).		VIII. (3 of 6″).		IX. (8 of 3″).	
		As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.
1	9.10.29	4·48	15·07	4·82	18·63	5·33	19·88	5·45	19·09	5·64	17·88	5·76	20·37	5·82	22·03	6·19	21·13	5·17	21·53
2	4.11.29	4·51	20·09	6·73	24·28	3·95	22·95	4·56	23·57	7·24	18·89	3·97	21·29	4·16	22·74	4·30	22·69	4·40	22·60
3	27.11.29	4·58	22·04	4·55	22·98	4·62	23·28	4·70	23·65	6·49	26·56	5·22	23·81	5·29	24·71	5·46	25·13	4·84	24·94
4	20.12.29	4·77	24·46	4·29	22·94	4·34	23·31	4·14	22·19	7·99	24·15	5·20	23·10	5·04	22·72	4·85	21·51	5·61	25·31
5	7.1.30	5·66	24·50	5·24	26·77	5·33	27·22	4·91	24·70	8·39	28·73	6·57	23·58	6·34	22·32	5·19	25·50	5·04	26·73
6	29.1.30	6 30	22·56	6·33	24·52	6·93	26·44	6·45	23·98	9·53	21·89	6·19	24·45	5·57	20·65	7·07	22·37	5·80	23·86
7	18.2.30	6·63	26·03	6·28	27·52	6·04	27·63	6·19	28·43	No sample		5·86	26·31	7·63	19·28	5·72	26·59	7·11	24·58
8	11.3.30	6·27	28 38	4·92	29·10	4·75	28·96	4·71	27·37	5·18	28·58	4·27	25·90	4 60	22·46	5·73	27·01	5·24	27·86
9	12.4.30	6·55	24·22	5·62	26·79	7 01	27·20	6·58	25·87	8·72	23·20	6·53	25·64	6·52	24·44	6·67	22·90	5·05	27·99
10	24.6.30	5·65	24·23	5·97	27·62	7·26	27·92	5·70	26·75	6·16	27·51	5·39	25·91	4·81	25·43	5·40	25·47	5·24	25·96
	Average ..	..	22·45	..	24·55	..	24·81	..	23·94	..	22·80	..	23·66	..	23·08	..	23·68	..	24·69

Table 3.—Crude Fibre.

Cut No.	Date.	I. (6 of 3″).		II. (6 of 4″).		III. (6 of 5″).		IV. (6 of 6″).		V. (None).		VI. (5 of 6″).		VII. (4 of 6″).		VIII. (3 of 6″).		IX. (8 of 3″).	
		As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.
1	9.10.29	6·29	21·14	5·00	19·36	5·04	18·83	5·76	20·15	6·72	21·30	5·54	19·58	4·69	17·74	5·49	18·75	4·48	18·66
2	4.11.29	4·90	21·83	5·35	19·30	3·53	20·51	3·96	20·47	8·49	22·17	3·66	19·66	3·70	20·19	3·78	19·90	3·95	20·29
3	27.11.29	4·27	20·55	3·49	17·61	3·56	17·93	3·45	17·37	4·50	18·41	3·89	17·72	3·69	17·24	3·91	17·97	3·46	17·84
4	20.12.29	3·65	18·70	3·30	17·62	3·18	17·07	3·26	17·50	5·70	17·22	4·18	18·59	4·14	18·65	4·47	19·86	3 72	16·77
5	7.1.30	4·81	20·82	3·62	18·50	3·89	19·85	4·26	21·43	4·82	16·49	6·04	21·68	6·22	21·91	3·91	19·22	3·62	19·22
6	29.1.30	4·96	17·75	3·95	15·30	4·09	15·60	4·22	15·69	6·42	14·74	4·20	16·62	5·27	19·54	6·26	19·81	4·01	16·47
7	18.2.30	4·42	17·34	3·73	16·34	3·61	16·52	3·46	15·89	No sample		4·19	18·84	9·05	22·86	4·11	19·13	4·90	16·96
8	11.3.30	3·57	16·17	2·59	15·34	2·56	15·59	2·77	16·09	3·12	17·18	2·89	17·51	3·64	17·78	3·90	18·38	3·14	16·69
9	12.4.30	4·40	16·26	2·93	14·03	3·54	13·73	3·48	13·69	7·75	20·61	3·75	14·72	4·15	15·58	5·09	17·50	2·65	14·70
10	24.6.30	3·88	16·64	3·28	15·21	3·74	14·40	3·25	15·23	3·27	14·60	3·33	16·02	3·02	16 00	3·19	15·07	3·18	15·75
	Average ..	..	19·11	..	17·40	..	17·62	..	18·16	..	18·82	..	18·18	..	18·27	..	18·64	..	17·62

showing calories per 100 grams, and in Column I showing nutritive ratios. There is, therefore, no evidence that increased yields with certain waterings are obtained at the expense of nutritive or feeding value.

This is shown graphically in Fig. 1 where the curve of feeding value as total calories shows a distinct parallelism with the curve of weight of produce. The total yield of crude protein, typical of one of the individual constituents, is also graphed, and this curve, as would be expected, also has the same form as the others.

As the quality of the pasture remains reasonably constant, irrespective of waterings, it follows that, in these particular trials, weight of produce may be taken as the only factor that need be considered in assessing from a feeding point of view the relative values of the different rates and frequencies of watering. From a practical stand-point, continuity of feed is also important and cannot be overlooked.

(2) Without materially affecting the generalization in (1), Column F shows that the relative feeding values of Plots 1, 5 and 8 are slightly but significantly less than those of the remaining plots. A study of Fig. 1 reveals the same fact. Plot 5 (no water) has the lowest value. Plot 1 (6 of 3 inches) and Plot 8 (3 of 6 inches) are practically the same, and this would indicate that 18 inches (or less) is not quite sufficient water to produce grass

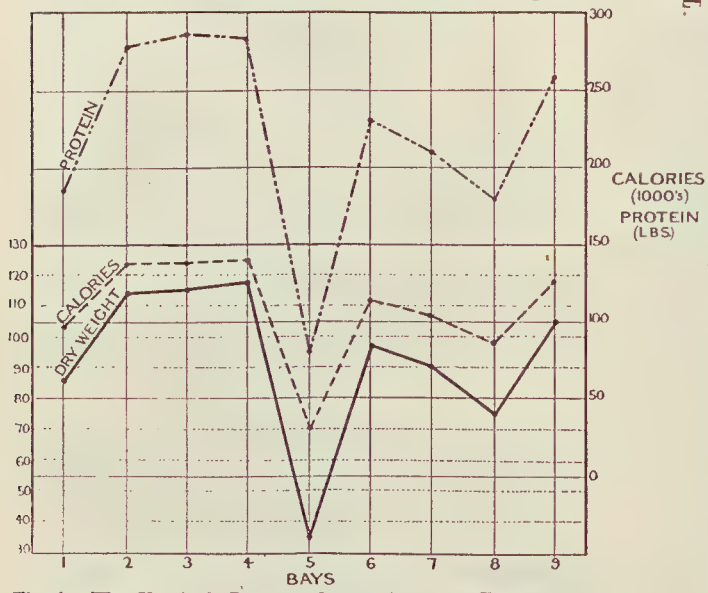


Fig. 1.—The Vertical Column shows Weight of Dry Matter in Tens of lbs.

TABLE 4.—SILICA-FREE ASH.

Cut No.	Date.	I. (6 of 3").		II. (6 of 4").		III. (6 of 5").		IV. (6 of 6").		V. (None).		VI. (5 of 6").		VII. (4 of 6").		VIII. (3 of 6").		IX. (8 of 3").	
		As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.
1	9.10.29	1·94	6·53	1·95	7·54	2·17	8·10	2·25	7·87	2·23	7·07	2·13	7·52	2·04	7·74	1·99	6·80	2·00	8·32
2	4.11.29	1·70	7·58	2·55	9·21	1·52	8·82	1·92	9·95	2·49	6·49	1·76	9·46	1·61	8·79	1·78	9·37	1·71	8·77
3	27.11.29	1·80	8·65	1·80	9·09	1·67	8·41	1·66	8·38	2·14	8·76	2·00	9·13	1·91	8·92	1·97	9·08	1·88	9·70
4	20.12.29	1·63	8·36	1·17	6·24	1·40	7·54	1·34	7·26	2·27	6·85	1·93	8·57	1·86	8·37	1·75	7·76	1·88	8·49
5	7.1.30	2·35	10·16	2·10	10·71	2·10	10·74	2·21	11·12	2·74	9·39	2·61	9·37	2·35	8·29	2·04	10·05	1·87	9·92
6	29.1.30	2·40	8·58	2·31	8·94	2·44	9·33	2·42	9·00	3·26	7·49	2·28	9·01	2·41	8·93	2·40	7·60	1·94	7·98
7	18.2.30	2·38	9·35	2·22	9·74	2·09	9·57	2·03	9·32	No sample		2·08	9·33	2·74	6·93	1·86	8·65	2·49	8·62
8	11.3.30	2·34	10·61	1·80	10·63	1·74	10·59	1·66	9·66	1·93	10·65	1·63	9·87	1·74	8·47	2·28	10·74	1·73	9·19
9	12.4.30	2·33	8·63	1·79	8·54	2·22	8·63	1·97	7·76	3·00	7·98	2·27	8·90	2·33	8·75	2·38	8·19	1·55	8·60
10	24.6.30	1·68	7·23	1·73	8·01	2·06	7·93	1·61	7·55	2·23	9·94	1·61	7·72	1·55	8·22	1·55	7·32	1·66	8·20
	Average ..	..	8·41	..	8·82	..	8·94	..	8·97	..	8·09	..	8·92	..	8·38	..	8·55	..	8·75

TABLE 5.—CARBOHYDRATES AND FATS.

Cut No.	Date.	I. (6 of 3″).		II. (6 of 4″).		III. (6 of 5″).		IV. (6 of 6″).		V. (None).		VI. (5 of 6″).		VII. (4 of 6″).		VIII. (3 of 6″).		IX. (8 of 3″).	
		As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.	As Recd.	Dry Basis.
1	9.10.29	15·30	51·39	13·12	50·73	13·21	49·32	14·20	49·73	15·28	48·44	13·83	48·86	12·82	48·53	14·16	48·35	11·56	48·21
2	4.11.29	10·31	45·91	12·40	44·74	7·60	44·16	8·43	43·60	17·77	46·40	8·82	47·32	8·17	44·62	8·55	45·08	8·66	44·46
3	27.11.29	9·54	45·90	9·51	47·94	9·54	48·09	9·51	47·89	10·41	42·63	10·36	47·23	10·16	47·49	9·99	45·95	8·86	45·64
4	20.12.29	8·95	45·93	9·43	50·41	9·22	49·48	9·38	50·29	15·63	47·21	10·70	47·53	10·54	47·56	10·78	47·96	10·39	46·89
5	7.1.30	9·40	40·68	8·04	41·05	7·74	39·54	7·83	39·38	11·20	38·38	11·65	41·86	12·13	42·70	8·53	41·95	7·74	41·04
6	29.1.30	13·34	47·73	12·48	48·33	12·02	45·89	12·95	48·20	18·90	43·40	11·81	46·67	12·43	46·04	14·35	45·42	11·34	46·64
7	18.2.30	11·45	44·95	10·09	44·17	9·53	43·54	9·50	43·67	No sample		9·36	42·03	18·28	46·18	9·00	41·92	13·50	46·65
8	11.3.30	9·56	43·31	7·38	43·63	7·18	43·70	7·82	45·50	7·54	41·55	7·41	44·88	10·04	48·93	8·97	42·29	8·38	44·50
9	12.4.30	13·29	49·14	10·25	48·78	12·50	48·51	12·88	50·68	15·63	41·56	12·40	48·71	13·06	48·99	14·51	49·81	8·48	47·00
10	24.6.30	10·67	45·83	9·80	45·37	12·23	47·03	10·20	47·92	9·21	41·12	9·68	46·54	8·92	47·21	9·70	45·73	9·50	46·99
	Average ..	..	46·35	..	46·53	..	45·82	..	46·37	..	44·67	..	46·50	..	46·96	..	45·56	..	46·07

TABLE 6.—SUMMARY SHOWING TOTAL PRODUCE AND FEEDING VALUE OF EACH PLOT ($\frac{1}{8}$ ACRE) FROM TEN CUTS DURING SEASON.

Plot.	Watering.	A.	B.		C.		D.		E.		F.	G.	H.	I.	J.
		Total Yield in lb. of Dry Matter.	Crude Protein.		Crude Fibre.		Soluble Mineral Matter.		Carbohydrate and Fat.		Calories per 100 grms.	Total Calories per Plot (1,000's).	Nutritive Ratio 1:	Nutritive Ratio omitting Cut 1. 1:	Nutritive Ratio of Cut 1. 1:
			Yield in lb.	Average %.	Yield in lb.	Average %.	Yield in lb.	Average %.	Yield in lb.	Average %.					
1	6 of 3″ ..	861	193	22·5	165	19·1	72	8·4	399	46·4	276	108	3·1	2·8	5·1
2	6 of 4″ ..	1,143	281	24·6	199	17·4	101	8·8	532	46·5	284	147	2·8	2·6	4·0
3	6 of 5″ ..	1,148	285	24·8	202	17·6	103	8·9	526	45·8	282	147	2·7	2·6	3·7
4	6 of 6″ ..	1,174	281	23·9	213	18·2	105	9·0	544	46·4	281	150	2·8	2·7	3·9
5	No water ..	342	78	22·8	64	18·8	28	8·1	153	44·7	270	42	2·9	2·5	4·2
6	5 of 6″ ..	977	231	23·7	178	18·2	87	8·9	454	46·5	281	124	2·9	2·8	3·6
7	4 of 6″ ..	904	209	23·1	165	18·3	76	8·4	425	47·0	280	115	3·0	2·9	3·2
8	3 of 6″ ..	754	179	23·7	141	18·6	64	8·6	343	45·6	277	95	2·8	2·8	3·4
9	8 of 3″ ..	1,043	258	24·7	184	17·6	91	8·8	480	46·1	283	134	2·7	2·6	3·3

(Continued on page 365.)

Rose Diseases and Their Control

(Continued from page 253.)

By B. J. Grieve, M.Sc. (National Society's Research Scholar ; Fred Knight and Wyselaskie Scholar).

XII.—ROSE ROOT ROT.

Armillaria mellea.

THE fungus causing Root Rot of roses is very common in Australia, being native in the sense that it was not introduced from another country, although it occurs as well in countries outside Australia. Massee[2], in England, states that it is the commonest and most generally distributed of any British fungus.

It may grow saprophytically in the soil during its whole life history, or it may, on the other hand, be parasitic. The host range of the fungus is very wide, and it may attack fruit trees, conifers, and ornamental plants.

In Australia the fungus is commonly present in orchards, since, when the land was first cleared for cultivation, old stumps of trees were left in the soil and formed infection centres from which the disease spreads.

The disease has been recorded on roses in the new nurseries in the hills in South Australia. It is reported as being less common there now. The disease has also been found on roses in Sydney, New South Wales, in 1925, while it has been known to be present in Victoria for some years[3]. No instances of the presence of *Armillaria* (the fungus causing the disease) have been recorded from Queensland, West Australia, or Tasmania.

Symptoms.

The effects of the disease are not apparent for a time, but sooner or later the root in the vicinity of the fungal strands becomes soft and spongy. If the spongy bark be lifted, a white dendritic or fan-shaped mass of fungal threads will be seen; this infection may spread from the roots to 6 to 8 inches above soil level. The bark at first becomes sodden; later it drys and splits, often falling away and exposing the characteristic white mycelium.

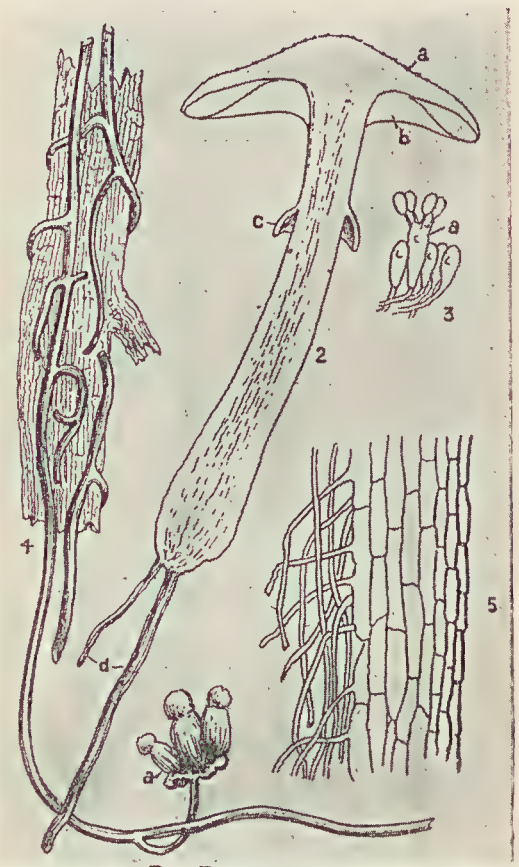


Fig. 16.—Rose Root Rot Fungus (*Armillaria mellea*).

2. Section of fungus. 3. Basidium with paraphyses. 4. Portion of root with branching strands of mycelium surrounding it. 5. Section of rhizomorph (mag).
(After Massee.)

The presence of the disease in a garden is indicated by a strong distinctive odour of mushrooms, which may be detected on calm, warm evenings. Rose bushes attacked by the fungus are stunted in growth, and the leaves fall early. The plant dies out in from one to ten years. Sometimes prior to the

death of the plant, but generally a year later, clusters of honey-coloured agarics arise from the soil in contact with the tree.

Etiology.

The causative agent in Rose Root Rot is a fungus *Armillaria mellea* (Vahl) Quel.

Morphology.

Sporophores in dense clusters, pileus 2-5 inches across, convex, then expanded, more or less olive brown when young, changing to dingy yellow or honey colour when fully developed, and ornamented with minute darker scales; gills attached to the stem, dingy white, stem 3-5 inches long, coloured like the pileus, more or less ragged below the large ring situated near its apex, spores white, elliptical 9 x 5.6μ

Life History.

Massee[2] gives the life history of the fungus as follows:—Spores are produced in great abundance, and these germinate under favourable conditions giving rise to a mycelium, which penetrates the root of the plant, gradually passing into the collar, and lower portions of the stem.

The mycelium shows as a white sheet on lifting the bark of the lower portion of a rose plant killed by the fungus. The white mycelium between the wood and the bark often presents a fasciated or fan-like appearance and breaks up into strands which may pass out through the bark, and form rhizomorphs on the surface, which in the case of the roots pass into the soil. After the death of the plant these strands become black in colour, and form a complicated network. The rhizomorphs radiate out in every direction in the soil, growing by the tip only, and eventually attack the roots of other plants, by dissolving the cortex and giving rise to a sheet of white mycelium between the wood and the bark as above.

Control.

Rose bushes suspected of being infected with Root Rot should be removed and burnt. Young rose plants especially those on Adelaide briar stock, should be carefully inspected to see that none of the brownish-black strands referred to above are present. If any are present, one may treat the roots either with iron sulphate solution, or Bordeaux mixture (6-4-40), but it is more advisable to reject such plants since some of the fungus may be left unharmed and thus contaminate the soil. Hartig[1] has suggested isolating infected plants by digging a narrow trench about a foot deep round each plant. This prevents underground rhizomorphs from spreading to neighbouring plants. Any sporophores of the fungus should be collected and burnt before their spores are dispersed.

Rose Root Rot.—Bibliography.

1. Hartig, R., and Somerville.—The Diseases of Trees (Eng. Edn.), p. 207, 1874.
2. Massee, G.—Dis. of Cultivated Plts. and Trees.—Duckworth & Co., London, pp. 354-358, 1915.
3. Pescott, E.—Rose Growing in Australia, p. 118.

XIII.—ROSE WILT AND DIEBACK DISEASE.

This rose disease, which appears to be peculiar to Australia and New Zealand, causes much damage in rose gardens during epidemics of the disease. It has been found occurring on most classes of roses, but as yet little is known of varietal susceptibility.

History and Distribution.

Rose Wilt and Dieback disease first came into prominence between the years 1908-1912, during which years it was prevalent in Victorian rose gardens. In 1915 an epidemic of it occurred, causing considerable losses to growers. An investigation of the disease was then made by the Government Pathologist, who considered that the disease was bacterial in origin. The disease became rampant in Victorian rose gardens during the years 1927-1929, and an investigation was begun early in 1929 by the writer.

Rose Wilt and Dieback has been found occurring in other States of Australia (New South Wales, South Australia, Tasmania), and has also been reported from New Zealand. It has not been reported from other parts of the world.

Symptoms.

The symptoms of this disease are best described by setting them out in stages as follows:—

Stage 1.—The first observable symptom is a curiously recurved appearance of the leaves on young shoots. The leaves sometimes have an appearance of being balled or crowded together on the petiole. If touched they fall off, and they are noticeably brittle in texture.

Fig. 17.—Diseased Rose Plant showing Rose Wilt Stage. [Photo by B.J.G.

Stage 2.—Defoliation commences at the tips of the stems of affected plants and works down the stem. The leaves drop off at the slightest jar, or with a puff of wind; in some cases they assume a lighter green or yellowish colour before they drop off.

Fig. 18.—Defoliation occurring in Diseased Rose. [Photo by B.J.G.

Stage 3.—After an interval of one to two days the tips of the young stems begin to discolour and die back for a distance of one to two inches. The rest of the young stem then develops a characteristic translucent yellow-green appearance which may be noticeable for a day. Later on, towards the base of the stem, the translucent yellow-green appearance becomes intensified, and within a few hours this region at the base of the stem turns a brownish-black colour. Young leaf buds in the basal-browned area remain green for some time. This appearance is characteristic of the disease in the field.

Stage 4.—The whole of the stem gradually discolours and dies back, and this "dieback" condition may extend down into the older wood. Developing leaf buds become brown at the tips, and then rot away.

Fig. 19.—Rose Plant in "Dieback" stage. [Photo by B.J.G.

Stage 5.—In many cases the plant sends up one or more watershoots after the upper stems have died back. These, however, soon show signs of the disease, which progresses as described above.

Stage 6.—After showing all or part of the symptoms of disease as described above, a plant may to all appearances recover and continue normal growth for one or two seasons. Ultimately, however, disease symptoms show afresh, and the plant soon presents a withered and unsightly appearance.

Etiology.

Rose Wilt and Dieback disease is caused by a filterable virus. The infectious character of the disease has been demonstrated by inoculating healthy plants with filtered juice from diseased plants. Disease symptoms showed in the inoculated plants in ten to twenty days.

Control.

The investigations carried out by the writer* have progressed far enough only to allow of tentative recommendations for the control of the disease. These may be summarized as follows:—

1. Efforts should be made to keep down the aphis on the rose. It is considered probable that the aphis transmits the disease from diseased to healthy plants.

Nicotine solution, red oil, or some of the commercial insecticides may be used with success.

2. Infection is no doubt commonly brought about by using the same pair of secateurs for pruning numerous rose plants, without sterilizing the secateurs. It is recommended that secateurs be sterilized after pruning each plant. A good procedure is to work with two pairs, using them alternately, and thus allowing sufficient time for sterilizing. A fairly dilute solution of formalin or mercuric chloride should be used for sterilizing secateurs.

3. Budding from diseased plants also may result in transmitting the disease. Buds should be selected from healthy plants, and care exercised in the operation of budding.

* A paper incorporating the investigations of the writer is being published shortly. Continued research on this disease has been interrupted by the writer's departure for England.

Chemical Studies of Pasture

(*Continued from page* 361)

of optimum feeding value, irrespective of yields. Increased watering above 24 inches has no effect at all on feeding value.

(3) It is apparent from the uniformly high protein contents, low fibre and narrow nutritive ratios that in all plots this irrigated pasture remains young when frequently cut. The pasture is of high feeding value, and is, in fact, a protein concentrate throughout the season. This conforms with published results on closely grazed pasture in other parts of the world.

(4) The mineral content is practically the same in each plot (Column D of Table 6 and Table 4), and is of a high order. Analyses of a number of cuts showed the amounts of phosphoric acid and lime to be adequate and similar in each plot, viz., 1 per cent. of lime (CaO) and .75 per cent. of phosphoric acid (P_2O5).

(5) The protein content and feeding value of Plot 5 are higher than might be expected from a "no water" plot, and are explained by the fact that lucerne predominated in this plot, and was almost the sole survivor of the original mixture.

(6) A study of Tables 2 to 5 indicates that there is an appreciable variation in composition from cut to cut, and there is some evidence to suggest that these variations are due to proximity of cuts to waterings and/or to heavy rainfalls.

Acknowledgment.

The analytical work in connexion with the investigation was carried out by the late Mr. F. C. Woods, M.Sc.

Farm Produce Agents Act

List of Licensed Agents.

THE following list of agents licensed under the Farm Produce Agents' Act is published for the information of growers and producers generally who, if they desire to secure the protection afforded by this legislation, should consign their produce only to firms or agents whose names appear below.

All complaints received by the Department of Agriculture from growers are thoroughly investigated and, so far as the Act will permit, every endeavour is made to protect them from unjust treatment. Unfortunately, the Act is being evaded by a number of persons who, having been refused licences, are trading as "cash buyers" and "merchants." Growers receiving circulars from so-called "cash buyers" or "merchants" are warned to make careful inquiries as to their bona fides before entrusting them with their produce.

There is a distinct difference between an "agent" and a "cash buyer." Under the Act no agent can sell farm produce without being licensed, and must return to the grower, within the time limit mentioned, the actual price he receives for the goods, less commission, freight, &c. The cash buyer, unless the price is mutually agreed upon beforehand, can return to the grower any price he deems fit, and the Act as it stands at present affords him no protection.

Reports of a statement made by the Hon. the Minister for Agriculture in the Legislative Assembly regarding the unsatisfactory and dishonest methods of certain of these merchants or cash buyers appeared in the daily press on the 17th June, the names of several being mentioned.

A Bill amending the present Act in the direction of further protection to producers has been prepared, and is to be submitted to Parliament by the Hon. the Minister at an early date.

Name of Licensee.	Court where Issued.
Acme Seed Store	Brighton
Anderson, D., and Co.	Horsham
Anderson, L. D., and R. S.	Prahran
Anderson, L. W.	Melbourne

FARM PRODUCE AGENTS—*continued.*

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Andrew, J., and Co.	Bendigo
Anguey, Robert	Melbourne
Anguey, William	Carlton
Associated Butter Factories Pty. Ltd.	Melbourne
Austral Grain and Ambler Pty. Ltd.	Prahran
Australian Egg and Export Co. Ltd.	Melbourne
Australian Mercantile Land and Finance Co. Ltd.	Brighton
Australian Estates and Mortgage Co. Ltd.	St. Kilda
Barrass and Co., W. F. Barrass trading as	Bendigo
Barker, Green, and Parke Pty. Ltd.	Bunyip
Barrow Bros. Commission Agency Pty. Ltd.	Melbourne
Barrow, H. R., and Sons	"
Bayfield, Edwin H.	"
Beasley, Thomas	Werribee
Beavis, Ralph Henry	Cheltenham
Belcher, Norman, and Co.	Geelong
Bell Banson Pty. Ltd.	Melbourne
Best, Spalding, and Bell	Ararat
Bird, Henry William	Wedderburn
Blackham, W. H. Pty. Ltd.	Prahran
Booth, Frank, and Sons	Malvern
Borrett, J. R., Pty. Ltd.	Melbourne
Borwick, Peter Sinclair	Colac
Bourke and Thewlis	Benalla
Box, Arthur D.	Frankston
Boyce, Wm. Francis	Camperdown
Brophy, Foley, and Co.	Ballarat
Brown and Dureau Ltd.	Melbourne
Bryant and Gourley	Ballarat
Bungaree and District Co-operative Society Ltd.	Bungaree
Burns, J. J., and Co.	Geelong
Burns, Louis Edward	"
Butler and Moss	Caulfield
Butter, Geo. W. Pty. Ltd.	Prahran
Campbell and Co.	Numurkah
Carter, H. R., and Co.	St. Kilda
Cashen, William Daniel	Wedderburn
Cavanagh, George	Camberwell
Cave, F., and Co. Pty. Ltd.	Melbourne
Chinn, Frank A., and Co.	"
Clements, C. E., and Co.	"
Cocks, Thomas James	Nathalia
Conaughton, John Patrick	Ballarat
Conn, Harry Ludwig	Charlton
Conomy and Thompson (James Harry Conomy, trading as)	Melbourne
Cooper, Edward	Ballarat
Co-operated Dried Fruit Sales Pty. Ltd.	Melbourne
Cope, Henry Edward	Box Hill
Cornish, R., and Son	Malvern

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Dalgety and Co. Ltd.	Flemington
Dalker, Edward	North Melbourne
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Davis, Louis	Melbourne
Dedrick, P. A., and Co.	Caulfield
Dennis, William	Bairnsdale
Donnellan, Laurence	Collingwood
Drevermann, F. D., and Co., Frank Octavius Drevermann trading as	Bairnsdale
Dreyfus, Louis, and Co.	Brighton
Durant, T. W., and Son	Nhill
Dwyer, John Thomas	Charlton
Ebbott, Kebby Pty. Ltd.	Melbourne
Falla and Petty	Donald
Fang Yock	South Melbourne
Ferris, Herbert	Kyneton
Fiedler, J. H.	Rochester
Foley Bros. Ltd.	Melbourne
Fox, Edmund John	Hawthorn
Foy and Co., Martin Joseph Foy trading as	Melbourne
Foy, James Allan	Malvern
Fraser, Harold L. C.	Prahran
Fraser, John	Bairnsdale
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Geraldton Fruit Co.	Melbourne
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Gidley, John	Melbourne
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Glasson, P. J., and Co.	Horsham
Gleeson, James Joseph	Warrnambool
Goldsbrough, Mort, and Co. Ltd.	Melbourne
Goulding, John F., Pty. Ltd.	Brunswick
Gratsch, Frederick William	Horsham
Gray, J., and Co., John McDowall Gray trading as	Ballarat
Gray and Son Pty. Ltd.	Donald
Green, Thomas C.	Bunyip
Greenfield, A. M., and Co.	Ballarat
Gregory and Son	Pyramid Hill
Hanger and Krerouse Pty. Ltd.	Melbourne
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Harrisons Ramsay Pty. Ltd.	Camberwell
Haughton, Wm., and Co.	Melbourne
Haynes, E. R., Pty. Ltd.	Malvern
Hayward, Samuel	Beaufort
Hecht, H., and Co.	Melbourne
Henderson, Robt. G. Pty. Ltd.	"
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Herrick, Patrick Ambrose	Rochester
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Hill, Harold Hereward	Wangaratta
Hinch, Herbert	Horsham
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King and Heath	Bairnsdale
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Ledger, Wann, and Co., Herbert	Benalla
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Overton, Ernest Alfred	Lilydale
Pack Kee	Melbourne
Parer, Salvador	,,
Parkes, Thomas Ernest	South Melbourne
Parsons, Robert	Caulfield
Patrikeos, Peter Andrew	Hawthorn
Pay, Ernest	Kerang
Peachey, R. A., Pty. Ltd.	St. Kilda
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Plant, Rolla Thomas	Horsham
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Ward, H. S. K., Pty. Ltd.	St. Kilda
Watkins, William Albert	Melbourne
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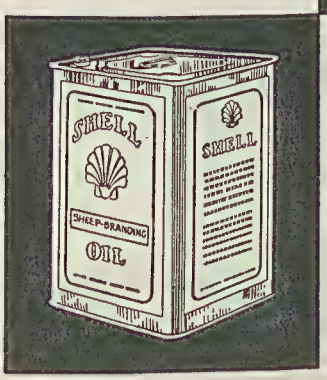

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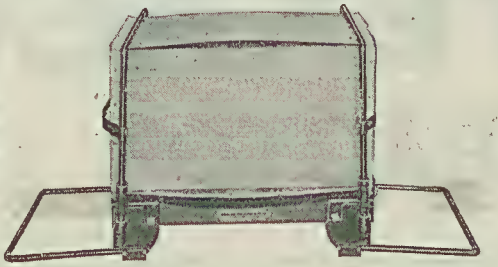

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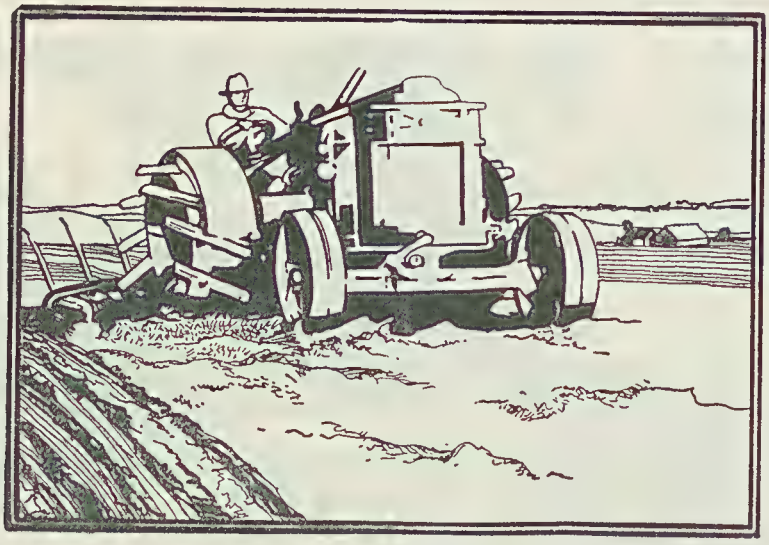

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Dam Victoria La Regal (718 A)
25 Guineas

2. *Born* .. .. 15th June, 1931
Sire .. Victoria Major Royal (817 AA)
Dam .. Victoria Braid (1654 A)
20 Guineas

3. *Born* .. 11th February, 1931
Sire Dominion Bright Belgian
Dam .. Victoria Euphrates (716 A)
24 Guineas

The prices quoted are based on the butter-fat production of the dam at the rate of 1/- per lb.

Inspection cordially invited. For further particulars apply to—

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or The Manager, State Research Farm, Werribee

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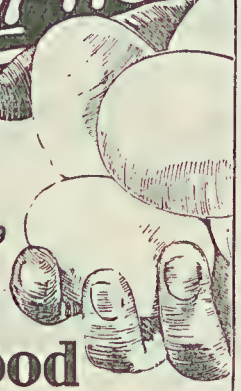

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"Dandy" is so pure as to be fit for human consumption, its preparation including roasting and sterilizing by a special dry steam process that reduces the fat and moisture to a minimum, yet retains the full nutritive values of the flesh and bone from which it is prepared. "Dandy" keeps its wholesomeness indefinitely.

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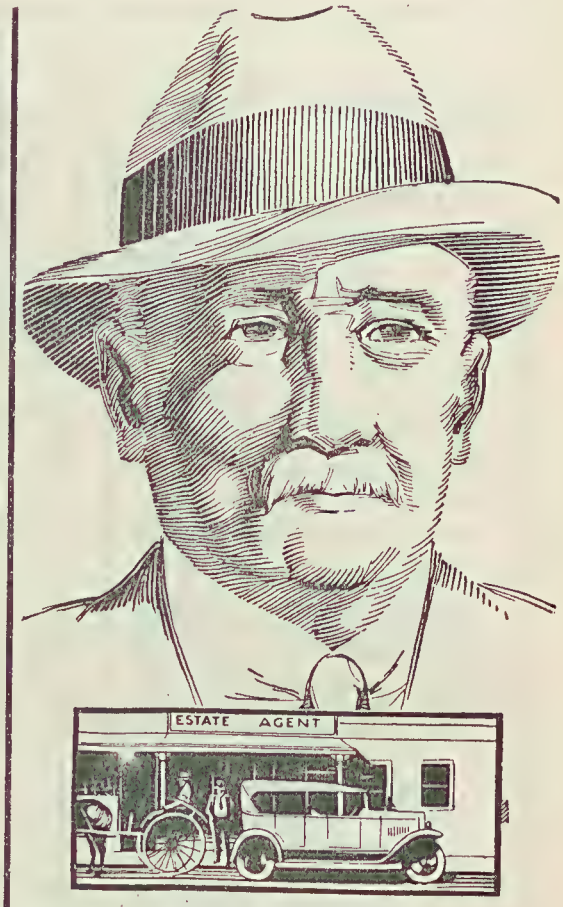

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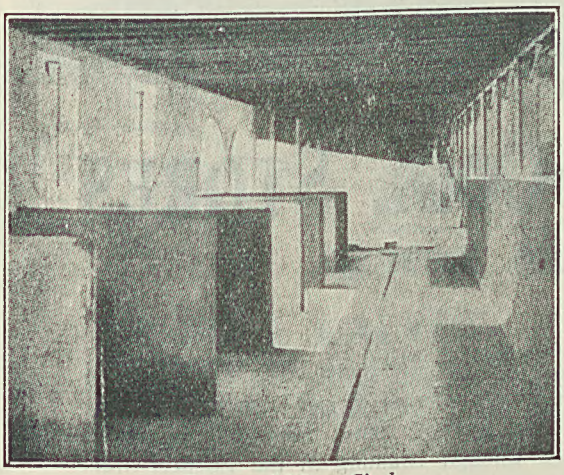

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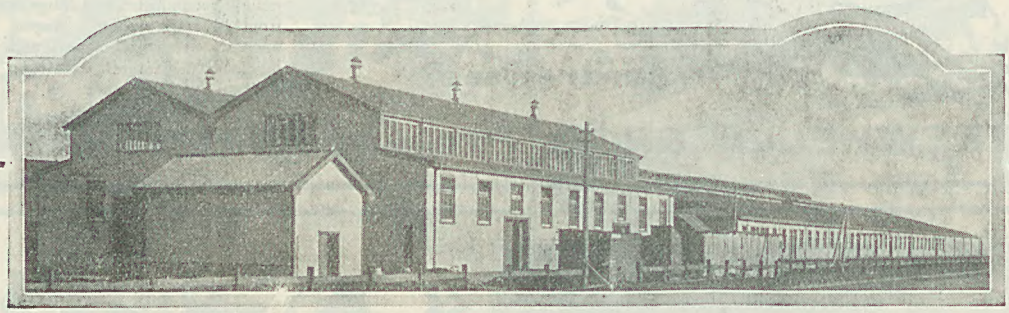

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Electric motor power totals 1,000 h.p.

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All are progeny of tuberculin-tested stock, and of cows tested in the Standard Herd Test. All are eligible for Registration in the Red Poll Herd Book of Australasia

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25 Guineas

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Sire .. ... Dominion Bright Belgian
Dam ... Victoria Euphrates (716 A)

24 Guineas

The prices quoted are based on the butter-fat production of the dam at the rate of 1/- per lb., except in the case of progeny of heifers without completed test, the price then being 10 guineas.

Inspection cordially invited. For further particulars apply to—

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6 oz. raisins
6 oz. currants
2 oz. candied peel
6 oz. suet
½ teaspoon carbonate soda
2 oz. brown sugar
1 teaspoon spice
½ cup treacle
1 cup milk

Shred suet, rub it into sifted flour, add crumbs and pinch salt, then add cleaned fruits, cut up peel, spice and sugar. Blend treacle and milk, stir all in and mix well.

Boil in greased pudding basin, with cloth tied on top, for four hours. Serve with white sauce.

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